Accomplishments in Tobacco Research in North Carolina

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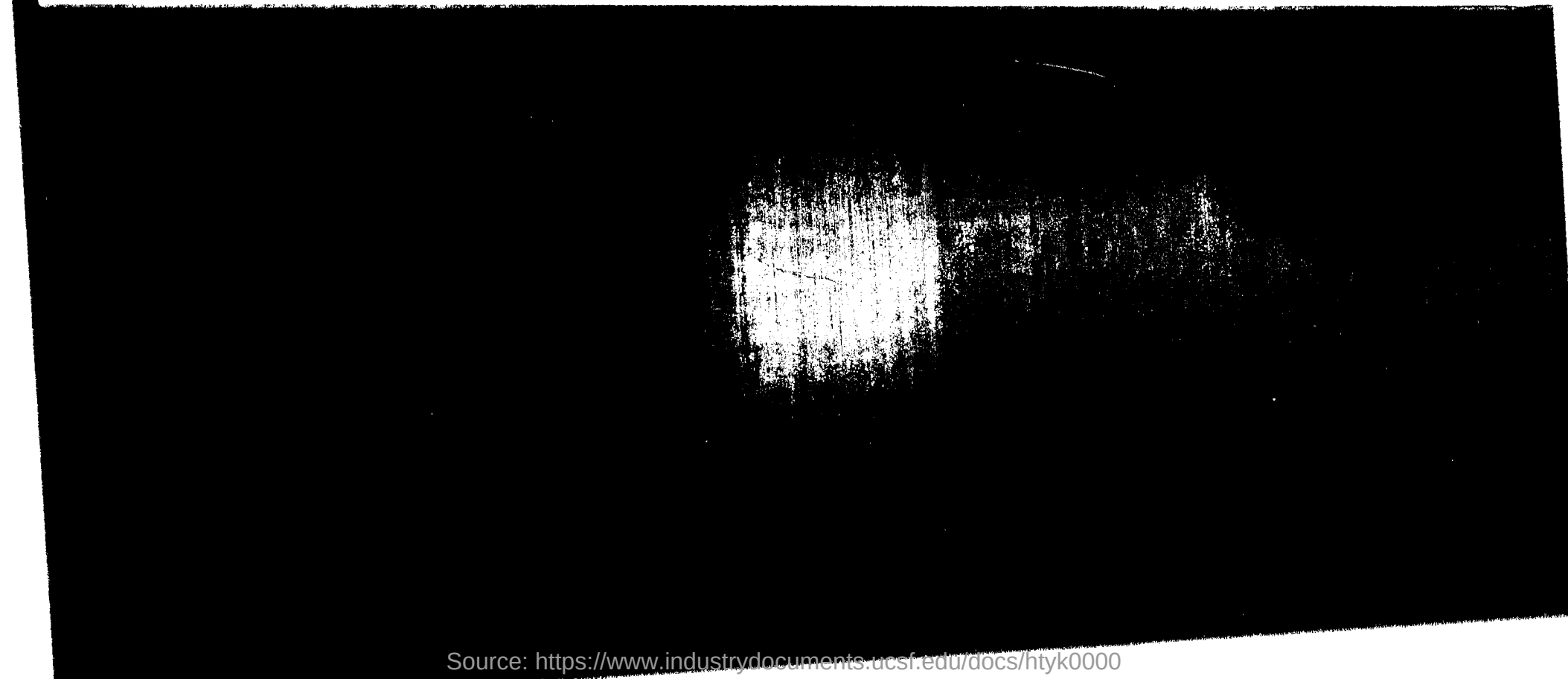
Accomplishments in Tobacco Research in North Carolina

April 1, 1983 - February 29, 1984



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This information presented in the annual report is NOT FOR PUBLICATION but represents preliminary findings which may later appear in published form. We trust you will find this information of interest and value.

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PREFACE

The North Carolina Agricultural Research Service supported 67 projects on various aspects of tobacco research in 1983. Fifty-five faculty members from 10 of the 20 departments in the School of Agriculture and Life Sciences devoted 20.2 scientist years (full-time equivalence) to tobacco research. Total expenditures during 1983 were approximately $4.0 million, at about the same level as in 1982. It is of interest to note that, 15 years ago (1968), 34 faculty from 9 departments devoted 24.6 scientist years to tobacco research with expenditures of approximately $1.4 million. During this period technician and professional support (graduate students and postdoctorals) has remained at about the same level.

The USDA-ARS Tobacco Research Laboratory at Oxford, N. C. is an essential component of our total tobacco research program; however, the above data do not include federal dollars expended in support of this laboratory.

Supplemental support provided by growers, warehousemen, leaf exporters and manufacturers of tobacco products through the North Carolina Tobacco Foundation continues to stimulate project leaders to strive for a "margin of excellence" that might not be obtainable with support only from appropriated funds. Dr. Hugh Kiger is to be commended for his outstanding leadership during the two years he served as President of the Foundation. Mrs. Isabelle Fletcher of Lenoir County was elected as President for the 1983-84 term beginning October 28, 1983.

We are pleased to have Dr. Rebeca C. Rufty, Assistant Professor of Crop Science, as a new faculty member to join our tobacco research group. In addition, during 1983 the following faculty members in Soil Science have become actively involved in tobacco research projects: Dr. Michael J. Vepraskas, Assistant Professor; Dr. Charles B. McCants, Professor; Dr. Greg D. Hoyt, Assistant Professor; and Dr. Glenn R. Bathke.

Four retirements occurred during the year. Mr. Wallace J. Dickens, Superintendent of the Border Belt Tobacco Research Station, Whiteville, N. C. was replaced by Mr. George B. Clark on February 1, 1984. Mr. A. H. Baumhover, Research Leader for the USDA entomology group at Oxford, recently retired on February 3; a replacement for this position has not been secured. Dr. Thurston J. Mann, Assistant Director of Research, NCARS, was replaced October 1, 1983 by Dr. William H. Johnson. Dr. Joe S. Chappell, Associate Professor of Economics and Business also retired during the year. The collective contributions of those who retired to tobacco research and to North Carolina's number one crop are beyond measure. We wish them well and will continue to seek their advice and guidance.

We are pleased with the overall accomplishments in tobacco research during 1983 and look forward to the new and exciting challenges of the 1984 season.

2000586839

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TABLE OF CONTENTS

Page

BIOCHEMISTRY

Ripening Agents for Tobacco 1
E. C. Sisler

BIOLOGICAL AND AGRICULTURAL ENGINEERING

Automated Transplant Culturing and Transplanting in Tobacco Production 3
B. K. Huang

Improved Systems for Transplant Production and Direct Seeding of Tobacco 24
W. H. Johnson and S. C. Mohapatra

Optimization of Tobacco Curing Systems 31
W. H. Johnson

Mechanization of Tobacco Production 35
C. W. Suggs and R. W. Watkins

Development of Instrumentation to Measure Quality and Composition of Tobacco 45
W. F. McClure, Ralph E. Williamson and F. G. Giesbrecht

BOTANY

Relationship Between Nuclear DNA Changes and Plant Productivity in Anther-Derived Doubled Haploids of Nicotiana tabacum 57
J. P. Miksche, S. S. Dhillon and E. A. Wernsman

Tobacco Growth Regulators and Plant Uniformity 58
H. Seltmann

Environmental Modification of Plant Reproductive Potential: Cyto-histological Changes in the Apical Meristem of Tobacco 65
Judith F. Thomas

CROP SCIENCE

Tobacco Tissue Culture and Cytogenetics 67
S. M. Reed

Tobacco Breeding and Genetic Research 71
James F. Chaplin

Tobacco Breeding for Germplasm and Varieties Resistant to Pests and Advantageous to Health 75
G. R. Gwynn

2000586840

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Page

Genetic Investigation of Tobacco and the Nicotiana Species 80
V. A. Sisson

Varietal Evaluation Studies in Flue-Cured Tobacco 87
Daryl Bowman

Effective and Efficient Weed Management Programs for Corn, Tobacco, Small Grains and Sorghum 91
A. D. Worsham, Robert L. Davis, Richard Lemons, Sandra Doyle and R. F. Walls

Vegetation Control in No-tillage Crop Production 97
A. D. Worsham, Robert L. Davis, Richard Lemons, Sandra Doyle and R. F. Walls

Nicotiana tabacum Carbohydrate Biochemistry 139
D. A. Danehower

Physiological Investigations in Flue-Cured Tobacco 142
R. C. Long

Improving and Automating Analytical Methodologies Required for Experimental Tobacco 148
W. W. Weeks

Evaluation of Volatile Compounds of Tobaccos Selected for Different Alkaloid Concentrations 149
W. W. Weeks

On-Farm Tests 1983 172
Robert L. Davis

ECONOMICS AND BUSINESS

Explanation of Size Distribution of Farms: Economic Models and Empirical Applications 176
Daniel A. Sumner

Cigarette Smuggling: The Demand to Smuggle and the Demand to Consume 178
Daniel A. Sumner

Analysis of International Trade Restrictions 180
Paul R. Johnson

ENTOMOLOGY

Tobacco Insect Control 181
Emmett P. Lampert

Tobacco Insect Control Means to Improve Tobacco Safety 192
D. Michael Jackson

2005089841

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Page

The Use of Feeding Deterrents in Pest Management of Soil Insects in Tobacco 209
F. Gould

Pesticide Residues in Tobacco, Tobacco Products, and Main-Stream Smoke 212
T. J. Sheets

GENETICS

Genetic Investigations in Nicotiana Species Populations 215
E. A. Wernsman and D. F. Matzinger

PLANT PATHOLOGY

Epidemiology and Control of Virus Diseases of Solanaceous Crops 225
G. V. Gooding, Jr.

Soilborne Diseases of Tobacco 228
H. D. Shew

Breeding for Disease Resistance in Tobacco 232
N. T. Powell and Margaret E. Daub

Transfer of Resistance Genes from Nicotiana repanda to Nicotiana tabacum by Protoplast Fusion 233
Margaret E. Daub

The Role of Photosensitizing Fungal Toxins in Plant Disease 235
Margaret E. Daub

Studies of Plant Disease Control, Tobacco Diseases 237
Harvey W. Spurr, Jr.

Epidemiology and Control of Foliar Diseases of Tobacco 240
C. E. Main

Disease Control Strategies for Burley Tobacco and Vegetables in Western North Carolina 247
P. B. Shoemaker

SOIL SCIENCE

Cultural and Nutritional Investigations with Flue-Cured Tobacco 250
G. S. Miner and M. J. Vepraskas

Environmental Determinants of Crop Growth and Soil Productivity 259
C. D. Raper, Jr.

Cultural, Nutritional and Varietal Investigations with Burley Tobacco 262
J. E. Shelton

2000586842

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Page

Cover Crops Evaluation and No-till Crop Production on Mountain Soils of North Carolina 267
G. D. Hoyt

TOBACCO LITERATURE SERVICE

Annual Report for the Calendar Year 1983 272
Carmen M. Marin and Paul A. Suhr

ADDENDUM 273

2000586843

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RIPENING AGENTS FOR TOBACCO

Edward C. Sisler, Project Leader

I. Summary of Research:

The major objectives of this project are:

A. To study the interaction of ethylene with the binding site and to relate conditions of binding with hormonal action.

B. To study the interaction of other compounds and hormones with the binding component and to relate their effects with physiological responses.

C. To purify the binding component so that the mechanism of action can be determined.

D. To do exploratory studies on the way binding is translated into physiological events.

Experiments have been conducted on a number of compounds in vitro, some of which have ethylene activity and some of which counter ethylene action. The results were correlated with in vivo data with respect to physiological responses. With respect to concentration, the in vitro data correlated well with the in vivo measurements. The in vitro binding of both active compounds and compounds which counteract ethylene's action was observed to correlate well with physiological responses. The reason some compounds cause an "ethylene-like" response upon binding, whereas others, by a similar degree, counteract ethylene by binding, remains unknown. Further experiments are needed to determine the mechanisms involved.

A study has been conducted on the distribution of the ethylene-binding component in plants. A wide variety of tissues are found to contain a binding component. Tobacco seeds have a small but measurable amount, which seems to imply a role for ethylene in tobacco seed germination. The significance of this is being investigated.

A number of components extractable from tobacco are being tested for their ability to alter ethylene-binding and tobacco-ripening activity. Attempts will be made to correlate these effects with physiological ripening.

II. Graduate Students:

A. Beggs, Michael J. Candidate for Master of Science degree in biochemistry.

B. Hagen, Tory M. Special student, undergraduate.

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III. Manuscripts Accepted for Publication:

Goren, R., and Sisler, E. C. Ethylene binding: some parameters in excised tobacco leaves. Tobacco Sci.

Sisler, E. C. Distribution and properties of ethylene-binding component from plant tissue. In "Biochemical, Physiological and Applied Aspects of Ethylene." Martinus Nijhoff/Dr. W. Junk Publishers, The Hague.

Sisler, E. C., and Yang, S. F. Ethylene, the gaseous plant hormone. (a review) Bioscience.

IV. Manuscripts in Review:

Goren, R., and Sisler, E. C. Ethylene-binding characteristics in some annual and perennial plants. Scientia Horticulturae.

Sisler, E. C., and Yang, S. F. Anti-ethylene response of cis-2-butene and cyclic olefins. Phytochemistry.

V. Abstracts:

Sisler, E. C., and Yang, S. F. 1983. Effect of butenes and cyclic olefins on etiolated pea plants in relation to the ethylene response. Plant Physiol. 72:S40.

Beggs, M. J., and Sisler, E. C. 1983. Ethylene binding properties of mung bean extracts. Plant Physiol. 72:S40.

VI. Papers Presented at Professional Meetings:

Sisler, E. C. Distribution and characterization of ethylene binding component from plants. Presented at International Symposium on "Biochemical, Physiological and Applied Aspects of Ethylene," sponsored by the Ministry of Science and Development and the National Council for Research and Development, January 9-12, 1984, Qiryat Anavim, Israel.

VII. Graduate Student Thesis Completed During Reporting Period:

Beggs, Michael J. M.S. (completed December, 1983) Dissertation: Characterization of an ethylene binding site in plants.

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BIOLOGICAL AND AGRICULTURAL ENGINEERING

NC 05540: AUTOMATED TRANSPLANT CULTURING AND TRANSPLANTING IN TOBACCO PRODUCTION

B.K. Huang, Project Leader

I. Summary of Research:

Application of advanced technologies to tobacco production plays an important role in achieving improved quality and price competitiveness. Recent technological developments in agricultural engineering have brought about dramatic advancement in tobacco cultural mechanization. Yet, tobacco plantbed and field transplanting operations remain a major bottleneck in the total mechanization of the tobacco production system.

The greenhouse solar system (bulk-curing/greenhouse system or solar barn) is a large solar collector in which the tobacco and peanut curing process or plant production process is taking place for effective year-round solar energy utilization in agricultural production as well as for promotion of total tobacco mechanization in tobacco production. Research on fully automated transplanting of containerized seedlings and automated production of containerized seedlings under controlled environment in the solar barn has strongly suggested that not only the total tobacco cultural mechanization can be accomplished utilizing these current technologies, but also the tobacco quality and yield per unit area can be improved. Figure 1 shows the stationary and rotary layer automated transplant production system setup in the solar barn which was developed during the course of this research.

Materials and Methods

In this investigation, germination and growth studies were conducted for three selected types of transplant culturing trays (Fig. 2), the University, the Speedling, and the Japanese types. The University is a black thin plastic tray with conically or pyramid shaped cells tapered upwards with open-bottom to provide air pruning effect at the open bottom eliminating root-tangling or root-bound. The tray is adaptable to a fully automatic transplanter patented by N.C. State University and the individual seedling is automatically air pulled from the bottom at the time of transplanting. The Speedling is a white styrofoam tray with pyramid shaped cells tapered downwards with open-hole-bottom to provide air pruning effect of roots at the open hole. This tray is commonly used in the United States for growing tobacco transplants and other seedlings. The Japanese is a green thin plastic tray with pyramid shaped cells tapered downwards with closed-bottom with a hole, which is commonly used by Japanese tobacco farmers.

Commercially available McNair 944 tobacco seeds were sent to Germain's Inc. (Los Angeles, CA) for coating to obtain the coated seeds with average diameter of 1.78 mm so that they could be seeded with an automatic precision seeder.

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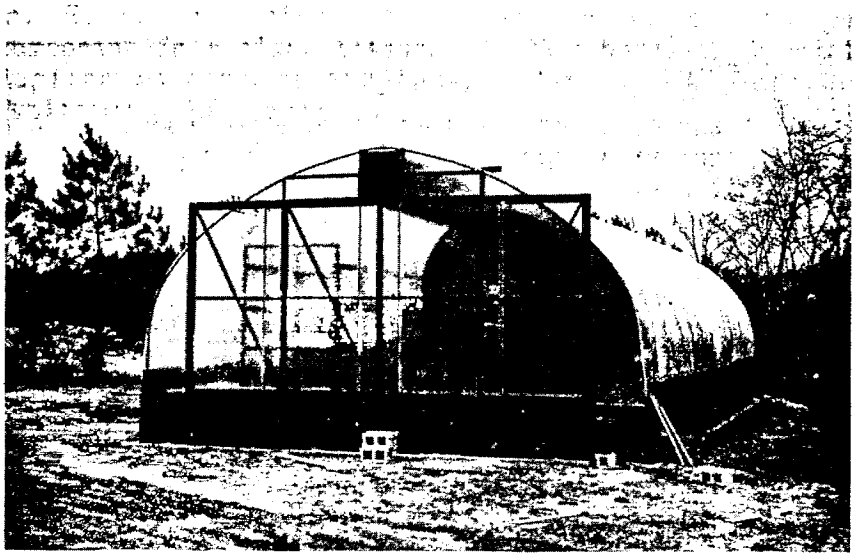

Fig. 1. Stationary and rotary layer automated transplant production systems in solar barn.

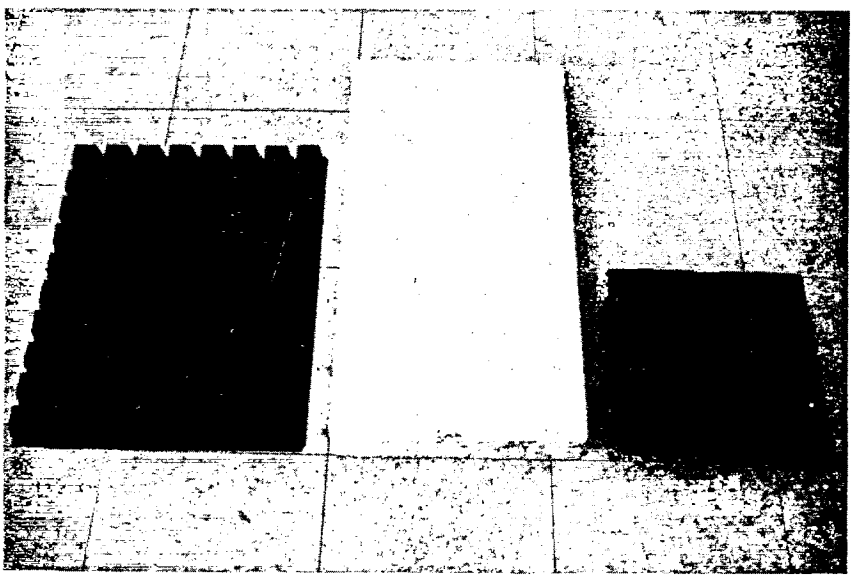

Fig. 2. Three types of transplant culturing trays, University, Speedling, and Japanese.

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Conventional plantbed was prepared at the Central Crops Research Station. About 3 g of McNair 944 tobacco seeds were uniformly mixed with Sodium Nitrate and uniformly hand sown over 6.97 m^2 (75 ft^2) plantbed three times on February 22, 1984. The plantbed was then covered with pine straw and nylon sheet. Sprinkler irrigation was used over the plantbed depending on weather conditions.

The germination and growth studies of containerized seedlings were conducted in the solar barn at N.C. State University campus. The solar barn is equipped with an oil furnace unit with airflow, temperature and humidity control devices, a multi-directional solar-collector furnace room, and a gravel solar-collector/energy-storage system to provide fully controlled greenhouse environment. Two types of automated seedling production systems were used. Figure 3 shows the stationary layer automated transplant production system which utilizes the portable frames (overall dimensions: 203.2 L x 162.6 W x 218.4 H cm) used for tobacco curing. Although the system can grow four tiers of seedlings only one layer (third from the top) was used in this study. Staggered two-row misting nozzles (White Showers, Inc., Lansing, MI) were used to provide timer-controlled uniform watering. Figure 4 shows the rotary layer automated transplant production system which utilizes a rotary solar drum (overall dimensions: 223.5 D x 457.2 L cm) used for peanut curing and grain drying. Single-row misting nozzles were used to provide uniform watering as the drum rotates periodically. Both systems were designed for maximum space utilization and for bulk handling of transplants. Both portable frame and solar drum have four caster wheels to roll in and out on the rails above the prenums of the solar barn to a trailer for easy bulk handling and transporting of seedlings to a transplanting site.

The trays were filled with moisted PRO-MIX (Premier Brands, Inc., New Rochelle, NY) using an automatic tray filler and the coated seeds were seeded with a precision automatic seeder to put a single seed on each tray cell at one time. Each tray was lightly covered with JIFFY MIX (JPA, West Chicago, IL) and laid on the perforated metal layers of stationary and rotary systems. Two seeding dates, 3/4/83 and 3/16/83 which were 10 days and 22 days after conventional plantbed seeding, were used to study the seed germination and transplant growth in the solar barn as well as to study the field growth dynamics of two transplant dates. Previous studies have indicated that optimum watering is the most important factor in growing uniform tobacco seedlings in the trays. Both overwatering and underwatering retards the root development and growth. Everyday from 8:00 AM to 6:00 PM, the stationary system was misted 50 s every 40 min, and the rotary system was misted 2.5 min during the periodic rotation every 2 h so that both systems provided about the same amount of watering per day. During cloudy or rainy days the watering intervals were extended 2-3 times to reduce the amount of watering. The daytime and nighttime air temperatures were respectively set for 32°C and 20°C to provide optimum growth environment.

Field growth dynamics of the containerized seedlings and conventional bare-root seedlings were studied from transplanting to harvesting at Field No. C5 (area 849.8 m^2) in the Central Crops Research Station. The area

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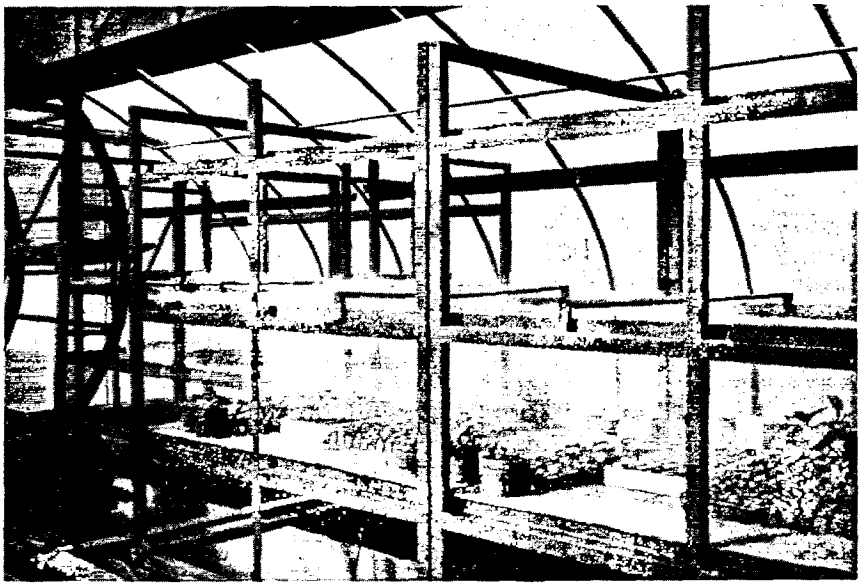

Fig. 3. Stationary layer automated transplant production system.

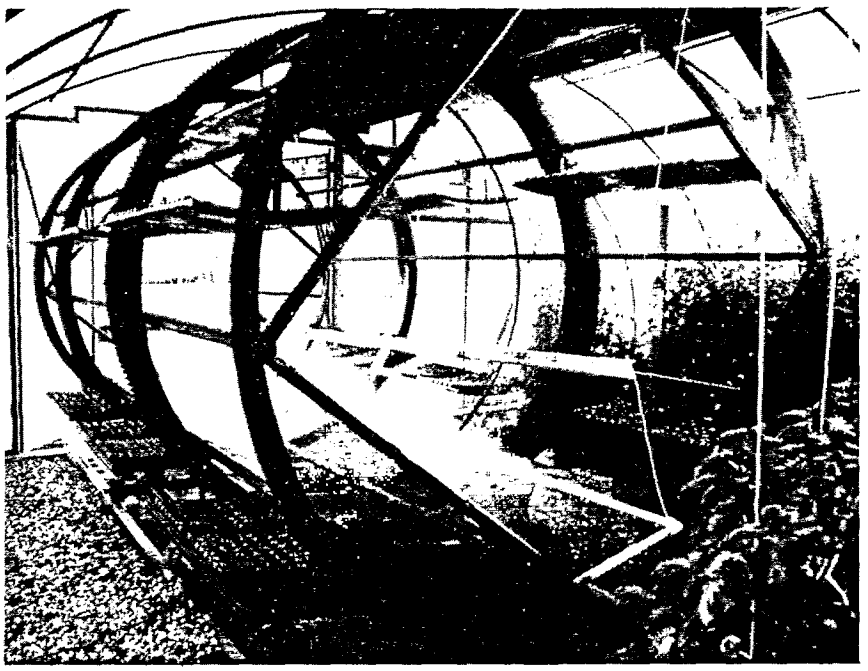

Fig. 4. Rotary layer automated transplant production system.

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was divided into 3 blocks, and each block was divided into 14 rows to plant 22 tobacco plants at 55.88 cm (22") intervals including two protective plants at the ends of each row. The row distance was 114.3 cm (45") with two protective rows at both sides of the test area. Ten treatments (one row each) of containerized transplants shown in Table 1 plus 4 rows of conventional transplants were randomly assigned to each of the three 14 row blocks. At the time of transplanting, the containerized transplants were randomly selected from a tray for hand transplanting, but for conventional method large uniform bare-root transplants were carefully selected for hand transplanting.

For the containerized seedlings germination and leaf number counts were taken during the transplant culturing in the solar barn. First and second transplanting dates were respectively April 29 and May 10, 1983. In the field study plant growth in bud height and stem diameter as well as yield in pound per acre was measured. The growth data and total yield data were statistically analyzed for each treatment, tray type, production method, seeding time, and transplanting time.

TABLE 1. TRANSPLANT SOURCE (TREATMENT) AND SYMBOLS

	System	Tray	Delay (days)	Symbol
Greenhouse	Stationary	University	10	SU 10
			22	SU 22
		Speedling	10	SS 10
			22	SS 22
		Japanese	22	SJ
	Rotary	University	10	RU 10
			22	RU 22
		Speedling	10	RS 10
			22	RS 22
		Japanese	22	RJ
Conventional		-	-	C

Results and Discussion

Results showed that germination rate was 95 - 97% under the controlled environment with no significant difference among the tray types, between rotary and stationary layer automated seedling production systems. Figures 5 and 6 respectively show the germination rate of 1st seeding (3/4/83) and 2nd seeding (3/16/83). The emergence frequency was excellent under the controlled environment provided by the solar barn. The germination rate exceeded 90% within 8 days for 1st seeding and within 6 days for 2nd seeding. These results were in good agreement with the 1978, 1979, and 1980 studies conducted in the solar barn at the Central Crops Research Station.

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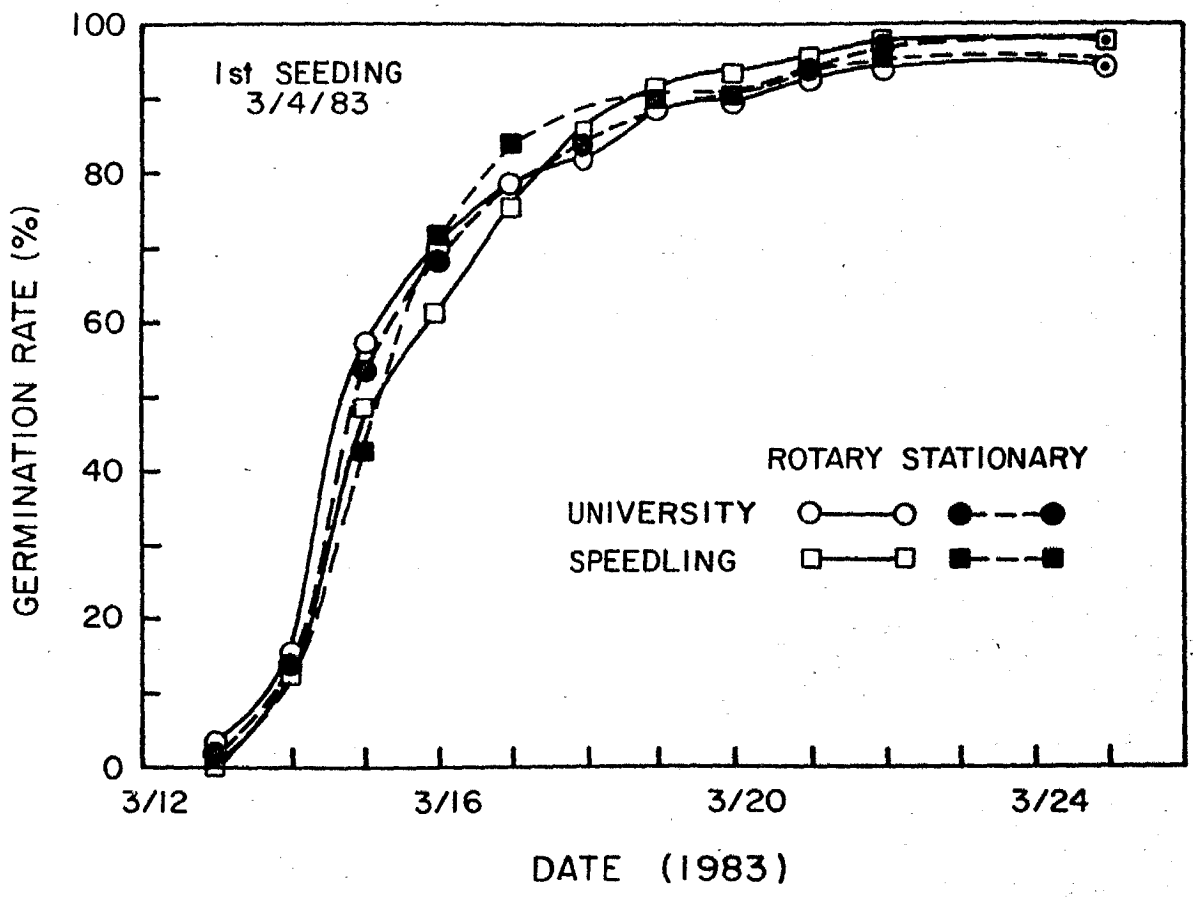

Fig. 5. Germination rate of coated tobacco seeds for lst seeding using automated transplant production systems in solar barn.

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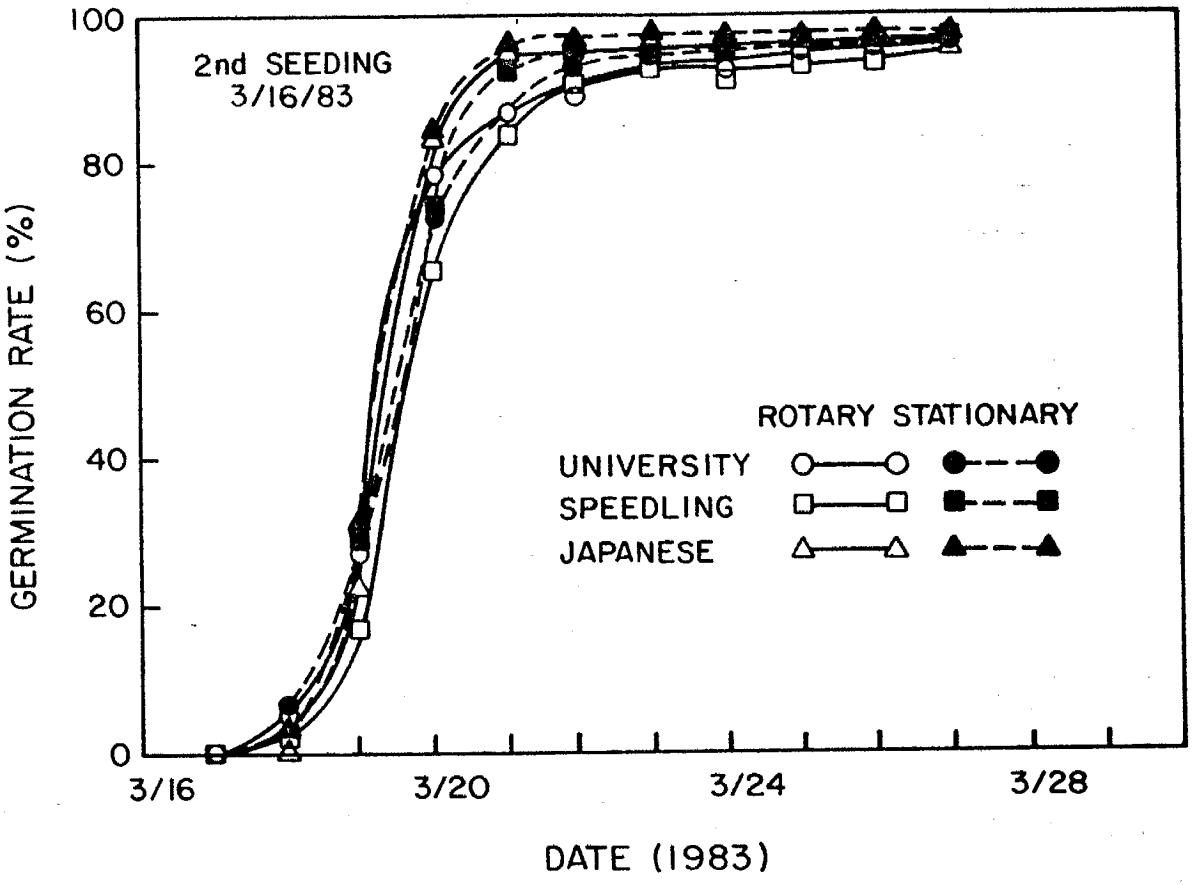

Fig. 6. Germination rate of coated tobacco seeds for 2nd seeding using automated transplant production systems in solar barn.

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The tobacco seedling growth measured by counting the number of leaves indicated that the University and the Japanese was significantly higher than the Speedling at the 1% level and most of the University was significantly higher than the Japanese at the 1% level. Figure 7 shows the growth comparison between the University and the Speedling for 1st seeding. Leaf count data taken at the conventional plantbed were also plotted for comparison indicating sudden increase in growth around 4/10/83. Figure 8 shows the growth comparison among various tray types for the 2nd seeding. Typical plant size and root formation from three types of tray cells are shown in Fig. 9 illustrating the containerized seedlings pulled out from each tray cell and after soil mix was washed out from the root zone. Figure 9(a) shows the effects of cell shape and air prunign on the root formation of the University and the Speedling. Inspection of seedlings from Japanese trays showed that some roots grew upward after reached the cell bottom, and therefore, the right plant shows when all the roots were directed downward. The overall plant size was largest for the University, a little smaller for the Japanese, and smallest for the Speedling. In order to study the reason, root-zone soil temperature in various trays were measured for sunny and cloudy days (Fig. 10). The curves show that soil temperature in the Speedling trays was considerably higher than both University and Japanese trays. The maximum soil temperature reached 42°C and exceeded 35°C for about 5 hr during a sunny day. Previous study on the effect of soil temperature on tobacco growth indicated that prolonged soil temperature above 35°C would retard the growth. In order to further investigate the remarkable differences in the growth performance among the types of trays used for transplant culturing, phytotron study was conducted to correlate root zone soil temperature and the seedling growth. The result indicated that 40°C root zone temperature retards the seedling growth. The optimum root zone temperature could be one of the factors for the superior performance of the University tray. Growing tobacco transplants under the controlled environmental condition in the solar barn allows faster seedling growth as compared to the conventional plantbed, and therefore, the total transplant growth period under the controlled environment is 2 to 3 weeks shorter than that of conventional plantbed. Containerized plants' variability on a tray was non-significant, and therefore, the containerized seedlings transplanted for field study were selected randomly from each tray.

High mortality rate of conventional transplanting due to adverse weather condition during transplanting time has been one of the drawbacks of using conventional bare-root transplants. Unusually frequent rainfall in May 1983 after the 2nd transplanting (86.87 mm from May 10-27) greatly reduced the mortality rate and the transplanting shock of conventional transplants. Only two transplants died out of 240 conventional transplants resulting in the survival rate of 99.2%. On the other hand, the rainfall after the 1st transplanting of containerized transplants or from April 29 to May 9 was only 4.06 mm, but all 600 containerized transplants survived resulting in the survival rate of 100%. In general the effects of various treatments on the growth rate of younger tobacco plants are more significant than older plants. Figure 11(a) shows that the effects of various treatment can be

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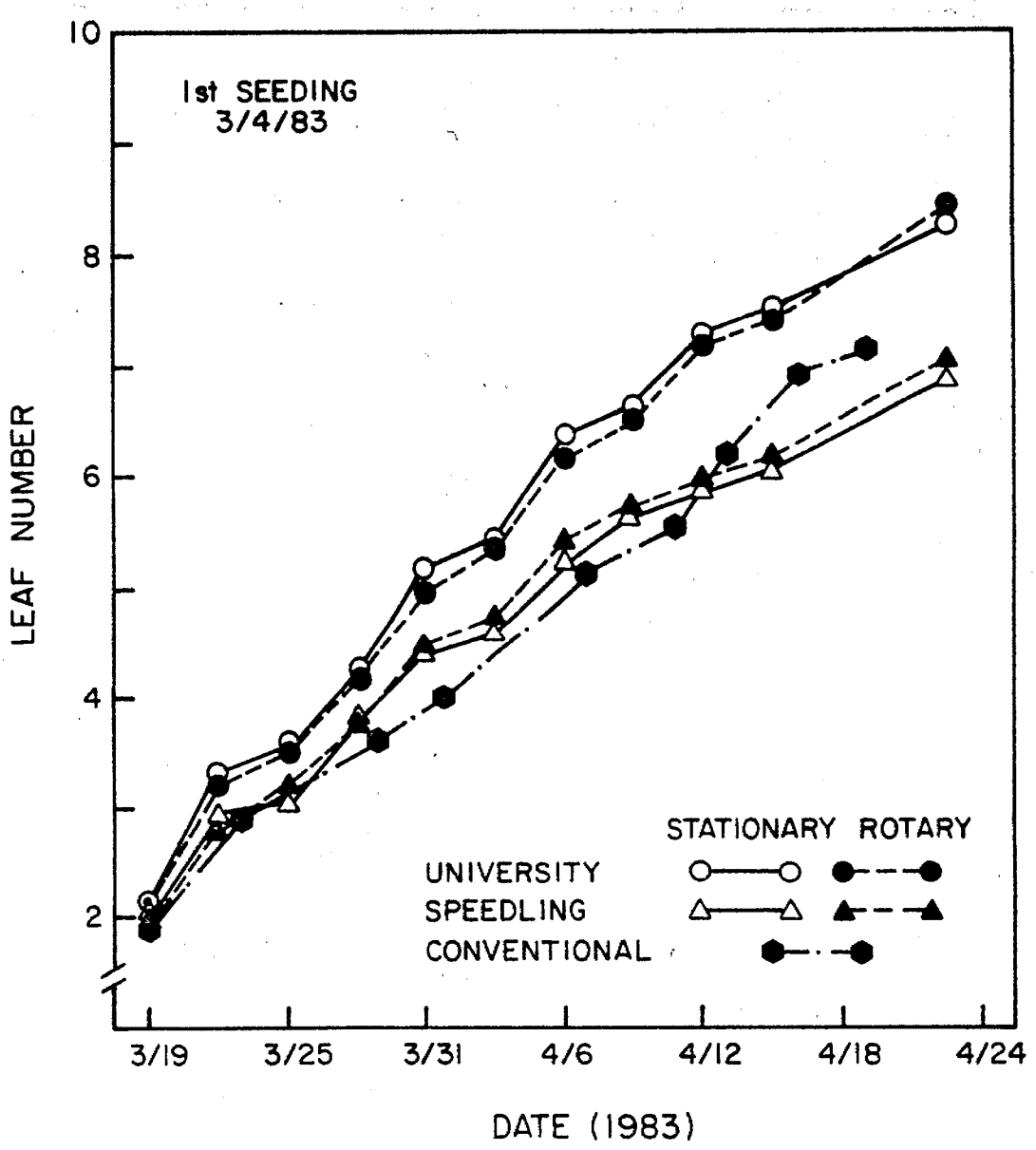

Fig. 7. Seedling growth comparison in leaf number for 1st seeding in solar barn and conventional plantbed.

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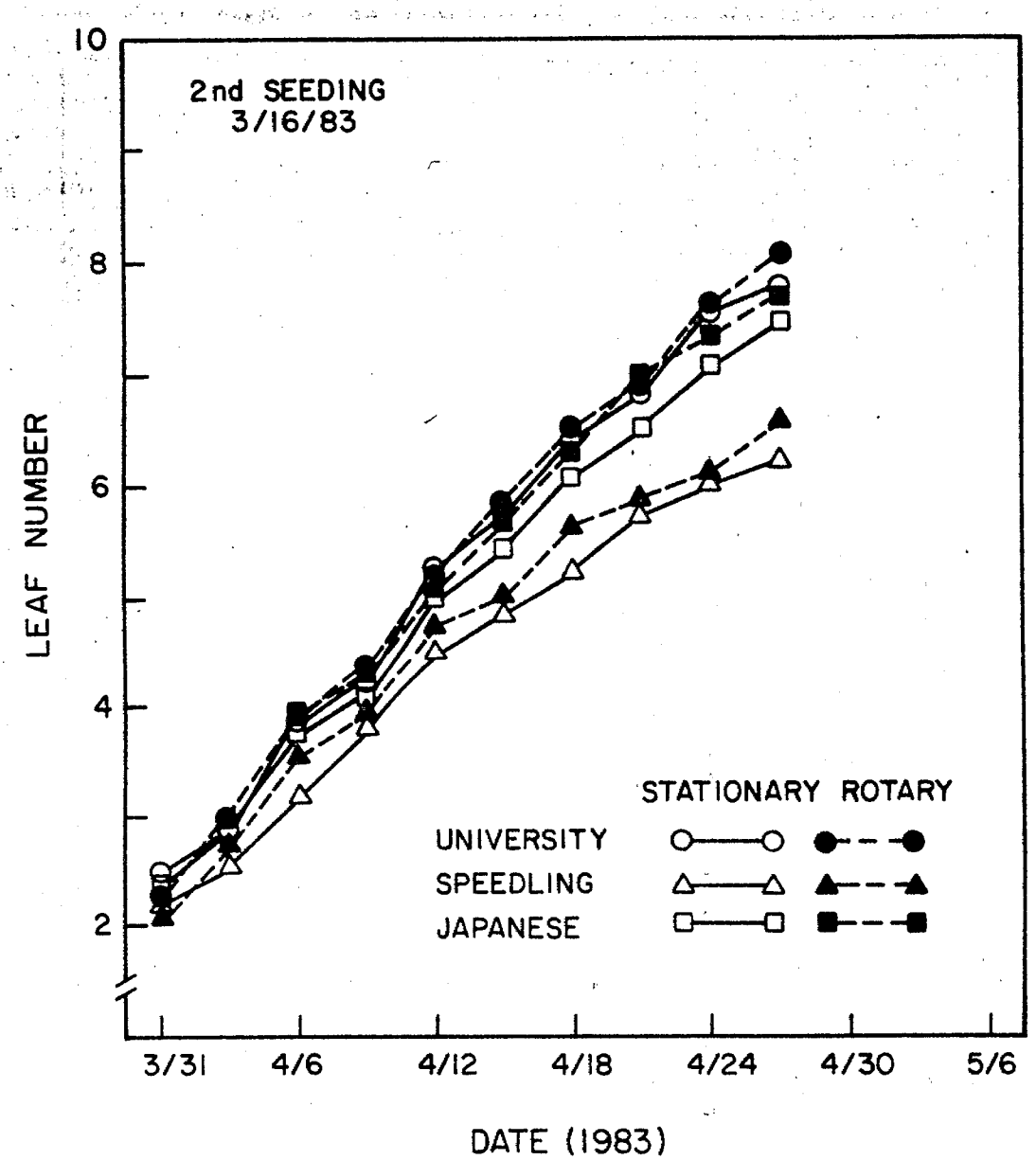

Fig. 8. Seedling growth comparison in leaf number for 2nd seeding in solar barn.

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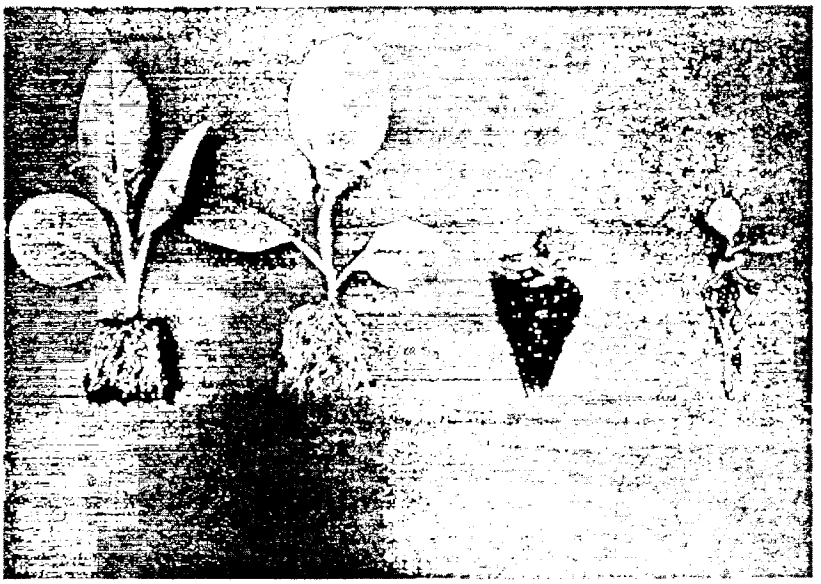

(a)

(b)

Fig. 9. Comparison of plant size and root development for typical 2nd seeding transplants from various trays: (a) University (left) and Speedling (right); (b) Japanese.

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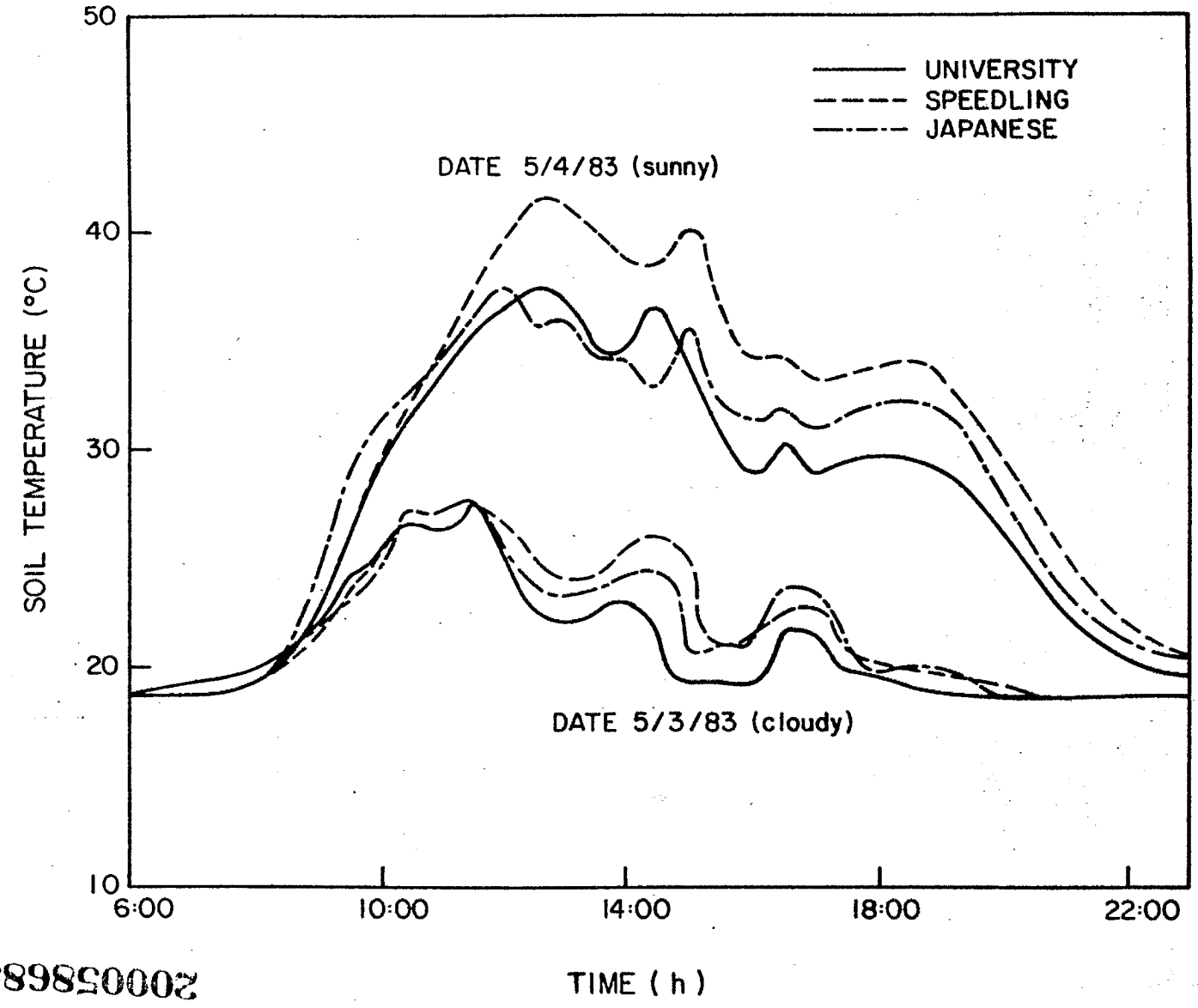

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Fig. 10. Root-zone soil temperature in various trays for sunny and cloudy days.

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(a)

(b)

Fig. 11. Field growth study for various treatments: (a) significant difference in growth due to treatment could be observed (6/3/83); (b) difference in growth was less as the plants approached maturity (7/22/83).

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observed for the plants about one month after transplanting. The difference in growth is not noticeable for matured plants as shown in Fig. 11(b). Therefore, continuous quantitative measurement of plant growth is indispensable for the comparative growth and yield study of various treatments. The bud height data plotted for growth curves and cumulative distribution are respectively shown in Figs. 12 and 13. The stem diameter data are shown in Fig. 14 with the dates of sprinkler irrigation. The field growth of the containerized transplants seeded 10 days after the seeding of the conventional plantbed was significantly better than the containerized transplants seeded 22 days after the seeding of the conventional plantbed and the conventional transplants until the unusual hot dry weather set in. The Station did not start irrigating the tobacco field until July 18 which was in time to save the conventional transplants and the "22" transplants, but was too late to save the "10" transplants affecting the total yield of the containerized transplants. Otherwise, the total yield of the containerized transplants was much higher than that of the conventional transplants. The growth and yield performance of the rotary layer system was in general better than the stationary layer system. The yield of "22" containerized transplants from the rotary layer system was about 10% higher than that of the conventional transplants (significance at the 1% level). This combined with the superior leaf-quality grades obtained by the containerized plants resulted in $220 - $330 per acre more income for containerized transplants in spite of adverse weather conditions. Tables 2 and 3 respectively show the yield of tobacco for various treatments and the results of SAS analysis.

TABLE 2. YIELD OF TOBACCO

Treatment	Yield	
	Kg/m²	lb/acre
SU 10	0.3518	3139
RU 10	0.3451	3079
SS 10	0.3362	3000
RS 10	0.3414	3046
SU 22	0.3603	3215
RU 22	0.3844	3430
SS 22	0.3781	3373
RS 22	0.3852	3437
SJ	0.3551	3168
RJ	0.3975	3546
C	0.3600	3212

Tables 4 and 5 respectively shows the earnings of tobacco based on 1983 flue-cured support prices for various treatments and the results of SAS analysis. Both field growth study after transplanting to harvesting and the yield study showed that in general the containerized transplants significantly exceeded conventional bare-root transplants in growth and yield. These results again agree well with the results of three-year field growth and yields study (1978, 1979 and 1980) conducted at the Central Crops Research Station. Figure 15 shows the typical root

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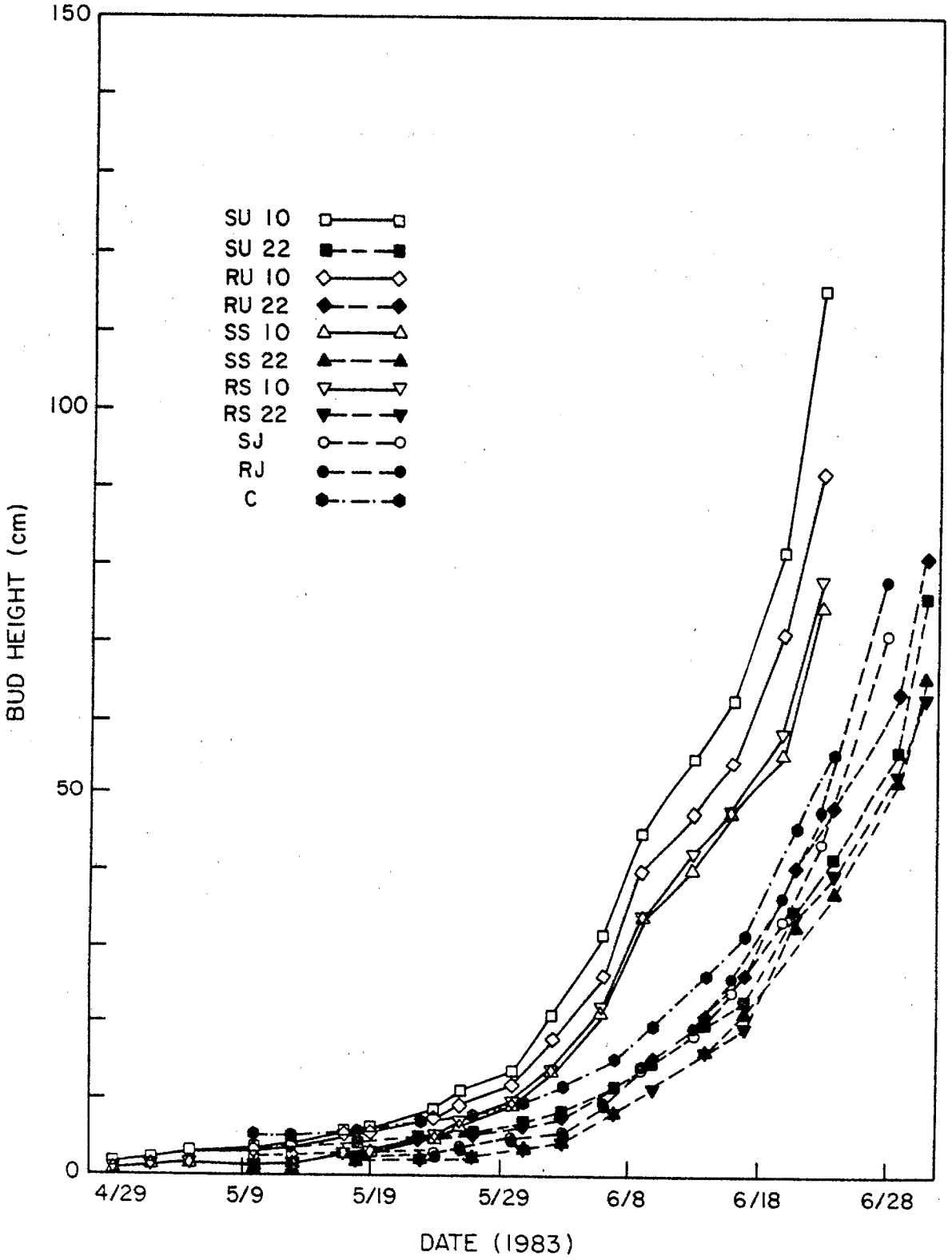

Fig. 12. Field growth curves in bud height.

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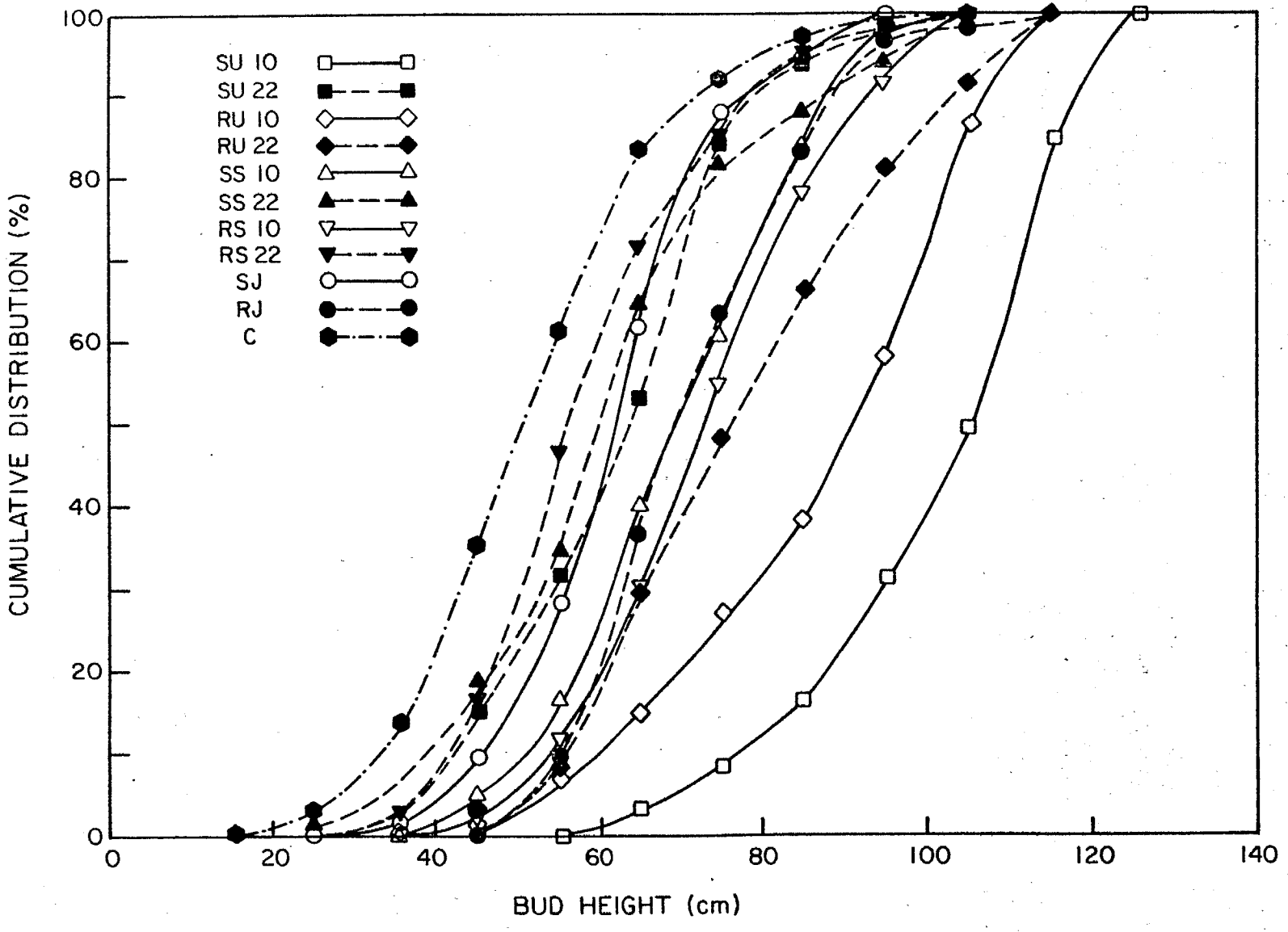

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Fig. 13. Cumulative distribution of bud height due to various treatments.

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

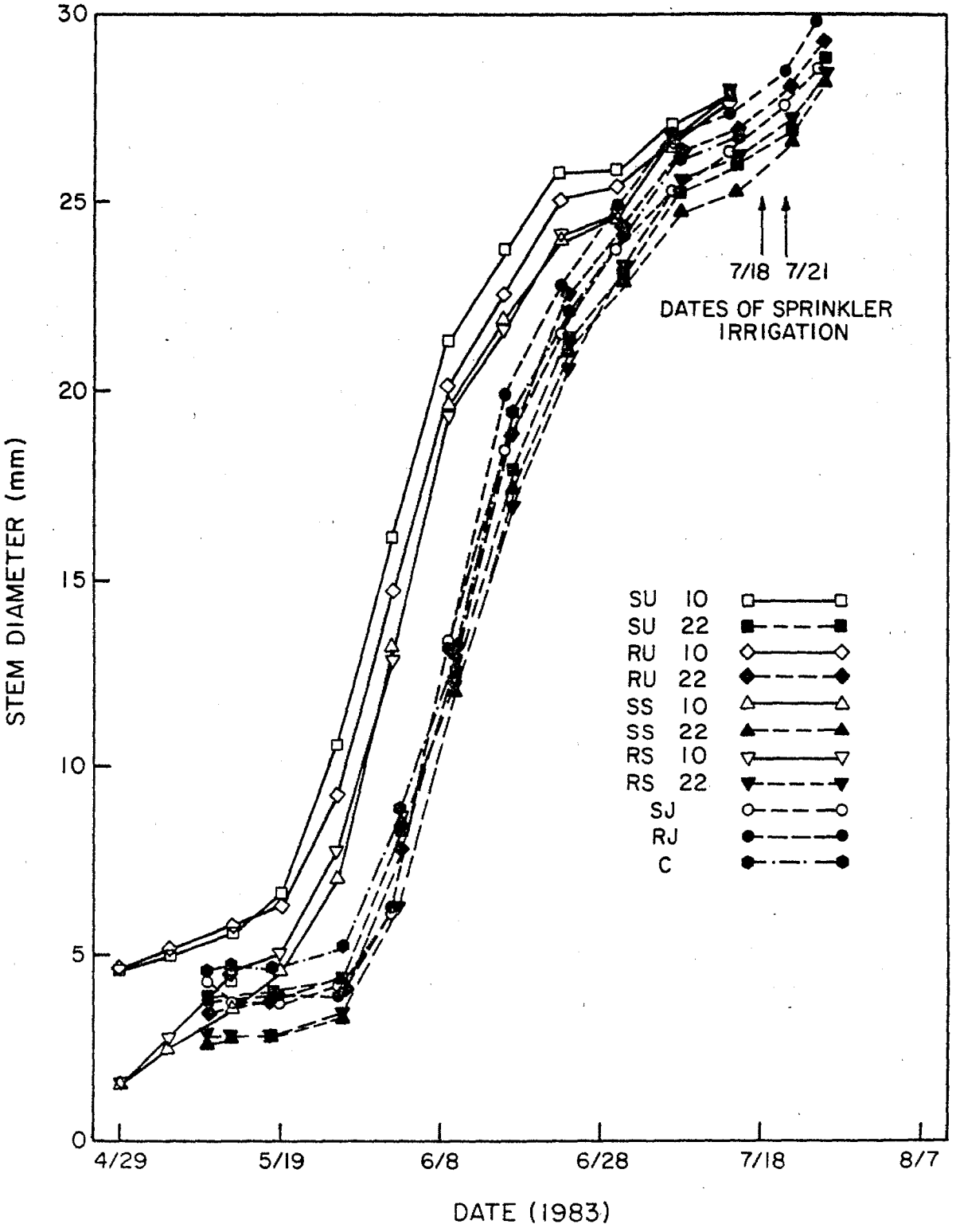

Fig. 14. Field growth curves in stem diameter.

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TABLE 3. SAS ANALYSIS OF YIELD

CONTRAST	DF	SS	F VALUE	PR > F
CONTAIN. VS C	1	0.00198165	0.23	0.6371
2NDCONTAIN. VS C	1	0.01722258	1.98	0.1704
FIRST VS C	1	0.07442634	8.54	0.0067
SECOND VS C	1	0.01722258	1.98	0.1704
FIRST VS SECOND	1	0.18497338	21.22	0.0001
ROTARY VS STATIONARY	1	0.02670083	3.06	0.0906
UNIV. VS SPEEDLING	1	0.00072930	0.08	0.7744
2NDR VS C	1	0.05282941	6.06	0.0200
2NDR VS 2NDOTHERS	1	0.06049125	6.94	0.0134
RS10 VS C	1	0.02896525	3.32	0.0786
RU10 VS C	1	0.03517229	4.04	0.0539
SS10 VS C	1	0.02039833	2.34	0.1369
SU10 VS C	1	0.03595133	4.12	0.0515
RJ VS C	1	0.04901470	5.62	0.0246
RS22 VS C	1	0.00698329	0.80	0.3781
RU22 VS C	1	0.02758470	3.16	0.0857
SJ VS C	1	0.00180950	0.21	0.6520
SS22 VS C	1	0.00318136	0.37	0.5504
SU22 VS C	1	0.00091807	0.11	0.7478

TABLE 4. EARNINGS

Treatment	Unit Price $/kg	Earnings $/m²	Earnings $/acre
SU 10	3.530	1.242	5026
RU 10	3.605	1.244	5034
SS 10	3.778	1.270	5140
RS 10	3.673	1.254	5075
SU 22	3.714	1.338	5415
RU 22	3.785	1.455	5888
SS 22	3.674	1.389	5621
RS 22	3.650	1.406	5690
SJ	3.745	1.330	5382
RJ	3.743	1.488	6022
C	3.767	1.356	5488

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TABLE 5. SAS ANALYSIS OF EARNINGS

CONTRAST	DF	SS	F VALUE	PR > F
ALLCONTAIN. VS C	1	0.00055821	1.20	0.2831
2NDCONTAIN. VS C	1	0.00360372	7.72	0.0095
FIRST VS C	1	0.00107468	2.30	0.1400
SECOND VS C	1	0.00360372	7.72	0.0095
2NDR VS 2NDOTHERS	1	0.00462590	9.91	0.0038
2NDR VS C	1	0.00652192	13.98	0.0008
2NDS VS C	1	0.00042901	0.92	0.3456
1STS VS C	1	0.00067600	1.45	0.2385
1STR VS C	1	0.00075808	1.62	0.2126
FIRST VS SECOND	1	0.00920491	19.72	0.0001
ROTARY VS STATIONARY	1	0.00182052	3.90	0.0578
UNIV. VS SPEEDLING	1	0.00000015	0.00	0.9858
RS10 VS C	1	0.00059661	1.28	0.2675
RU10 VS C	1	0.00033229	0.71	0.4057
SS10 VS C	1	0.00109910	2.36	0.1357
SU10 VS C	1	0.00005078	0.11	0.7439
RJ VS C	1	0.00480257	10.29	0.0033
RS22 VS C	1	0.00238140	5.10	0.0316
RU22 VS C	1	0.00224726	4.82	0.0364
SJ VS C	1	0.00000273	0.01	0.9396
SS22 VS C	1	0.00136708	2.93	0.0977
SU22 VS C	1	0.00005078	0.11	0.7439

formation of matured tobacco plant for the University (a), the Speedling (b), the Japanese (c), and the conventional, indicating that the containerized transplants resulted in well developed larger root masses.

The cost estimate to produce 1 acre of transplants in the solar barn was $55 including seeds, seed coating, soil mix, trays, electricity, and heating oil as compared to $44 per acre for conventional practice including seeds, fertilizers, fumigation, and plantbed cover. Abnormally rainy and cool weather in March and April increased the heating oil consumption for controlling environment in the solar barn. The labor required for seeding and transplant culturing was about the same for the greenhouse solar system and the conventional plantbed. However, the estimated labor requirement for the field transplanting is less than 6 person-hr/acre for the NCSU's two-row two-drop tractor-drawn automatic transplanter or two-row six-drop self-propelled automatic transplanter, and at least 18 person-hr/acre for the conventional two-row mechanical planter. The estimating transplanting time using the two-row two-drop automatic transplanter is about one-half of the time required by the conventional planter. The NCSU's two-row six-drop self-propelled automatic transplanter requires much less transplanting time.

The germination, growth and yield data obtained from 1983 experiment further confirms the advantages of applying the advanced technology in tobacco culture practice to overcome the current bottleneck in the total mechanization and energy conservation and to improve the quality and yield in tobacco production.

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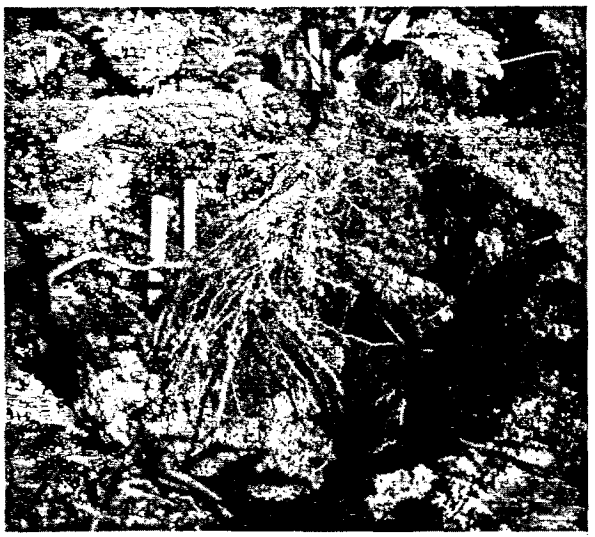
(a)

(b)



(c)

(d)

Fig. 15. Root formation of matured tobacco plants from various sources: (a) University tray; (b) Speedling tray; (c) Japanese tray; (d) conventional plantbed.

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II. Graduate Students in Tobacco Related Research:

None

III. Post-Doctoral Fellows and Visiting Scholars:

Dr. Akira Kato, Senior Researcher, The Japan Tobacco & Salt Public Corp.

IV. Publications:

Huang, B.K. and M. Toksoy. 1983. Design and analysis of greenhouse solar systems in agricultural production. Energy in Agriculture 2:115-136.

Huang, B.K. and V. Tayaputch. 1983. Design and analysis of a fluid injection spot and furrow opener. Greenhouse and Nursery Mechanization. A Compilation of Published Papers. ASAE Pub. 0183:64-69.

Huang, B.K., C.G. Bowers, Jr. and P. Oppenheim. 1983. Automated greenhouse seedling production for automatic transplanting. Selected Papers in Greenhouse and Nursery Mechanization Concepts. ASAE Pub. 0683:62-73.

Huang, B.K. 1983. Systems engineering of precision automatic transplanting. Selected Papers in Greenhouse and Nursery Mechanization Concepts. ASAE Pub. 0683:89-103.

V. Manuscripts Accepted for Publication:

Behroozi-Lar, M., B.K. Huang and H.D. Bowen. Circuit simulation of soil temperature profile.

VI. Manuscripts in Review:

Huang, B.K. and N.M. El-Shaik. Simulation analysis of greenhouse solar drying system for peanuts and grains.

Huang, B.K., M. Toksoy and Y.A. Cengel. Transient response of latent-heat storage in greenhouse solar system.

Huang, B.K. and C.G. Bowers, Jr. Development of greenhouse solar system for bulk tobacco curing and plant production.

Huang, B.K. and H.S. Chang. Circuit simulation analysis of heat transfer effect in solar drying.

Huang, B.K., C.S. Su, R. Takeuchi and Y.R. Chen. Noise attenuation characteristics of plant systems.

VII. Papers Presented at Professional Meetings:

Huang, B.K., M. Toksoy and Y.A. Cengel. Transient response of latent heat storage in greenhouse solar system. The 1983 ASAE Annual Meeting, Bozeman, Montana, June 26-29, 1983.

Huang, B.K. Year-round solar energy utilization in bulk-curing/greenhouse system. N.C. Solar Energy Association Annual Meeting, Raleigh, N.C., Oct. 14-23, 1983.

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NC 03801: IMPROVED SYSTEMS FOR TRANSPLANT PRODUCTION AND DIRECT SEEDING OF TOBACCO.

W. H. JOHNSON, Project Leader
S. C. MOHAPATRA, Co-Project Leader

I. SUMMARY OF RESEARCH (1983-84):

FIELD TRIALS ON MECHANIZED TRANSPLANT PRODUCTION

Field tests on mechanized transplant production were continued at the Lower Coastal Plains Tobacco Research Station, with examination of seed pre-treatment, seeding method, cover type and fertilization rate. Each of these factors had been found in previous work to significantly influence seed germination and uniformity of transplant production. The following observations were made:

1. Seed pre-treatment (DPI) while showing more rapid germination, appeared to reduce plant stand slightly in comparison with normal seed. With perforated plastic covers, a reversal was obtained, perhaps due to excess water entry which greatly reduced plant stand for the untreated seeds.

2. Two methods of seeding appear promising: fluid-drill seeding and precision seeding of coated seed. A new multi-row seeder for coated seed was developed and field tested. While the machinery worked exceptionally well, plant stand was reduced greatly in comparison with uncoated seed, apparently due to some problem in manufacture of the coated seed, which reportedly should have improved germination rate in comparison with uncoated seed. Fluid drill seeding continued to demonstrate practical advantages over conventional methods, with observed plant stands up to 81%.

3. Solid plastic (with shading) was found to provide better control of environmental conditions beneath the cover than perforated plastic covers. Utilization of a polypropylene shade cloth, placed directly over the solid plastic, served to prevent excessive temperatures which normally can injure or kill plants or germinating seeds. In addition, solid pastic was found to retain adequate moisture to assure germination and early plant growth.

4. Two fertilization rates tested indicated only slightly better results for 1600 vs 800 lb/acre of 12-6-6, as measured by plant stand. Earlier studies had shown damaging effects associated with higher (2400 lb/acre) rates of fertilization.

While the best results to date have been obtained for fluid drill seeding, solid plastic (with shading), intermediate fertilizer rates, and normal seed, plantbed factors need further examination. In particular, seed pre-treatment and method of seeding offer further potentials for enhancing plant stand, uniformity and quality of transplants.

CLIPPING AND UNDERCUTTING IN TRANSPLANT PRODUCTION

Because of potential advantages in relation to plantbed management, which

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enables improved uniformity and extending the harvest period, studies were continued to further examine the effects of clipping and undercutting of plantbeds. The studies in 1983 were essentially replicates of previously reported work in which beds were clipped several times and normal and clipped beds were undercut, followed by various time intervals prior to transplanting.

Observations made during 1983 further confirm previous findings: (1) multiple clippings at several stages of plant development appear essential for maximum benefit to improved plant uniformity; (2) undercutting stimulates plant root development while retarding shoot growth under plantbed conditions, there by resulting in gradually increasing root/shoot ratios during a 2 to 3-week period following undercutting (stimulated root growth may be advantageous to minimizing transplant shock and reducing loss of transplants); and (3) while the undercut plants appear to grow slightly faster and to a taller height, yields and value per acre were not appreciably different among the various treatments.

DIRECT SEEDING OF ORIENTAL TOBACCO
(In cooperation with W. W. Weeks)

Oriental tobacco has long been recognized as having unique aromatic characteristics, but is not produced in the United States because of high production costs. This project, initiated in 1978 is aimed at investigating a mechanized production system, including direct seeding and whole plant harvest, for potential production of this tobacco type. Major difficulties, however, have been experienced in achieving acceptable cured leaf characteristics. The study was continued in 1983 to examine factors of seeding density, fertilization level, and topping vs not topping on cured leaf properties. Also of particular interest was the examination of certain leaf components considered related to aromatic properties.

Procedures were essentially the same as described in the 1982 report, except for modification of treatment parameters. Populations of 40,000 and 60,000 plants/acre were established and grown under 0 and 20 lb N/acre rates. In addition to bulk curing of intact plants (two harvest dates), leaves were stripped from stalks and cured under laboratory conditions.

As in the previous work, the Izmir variety of tobacco produced less than desirable cured leaf properties under the conditions of the test. Examination of green/cured weight ratios suggests that the leaves had not developed much body, thereby yielding a low grade, thin tobacco having low aroma level and yield per acre. While numerous factors could be involved, it is speculated that these results are arising due to conditions that are currrently leading to (1) very rapid growth during early summer, (2) rapid deterioration and loss of leaves from the bottom of plant and progressive loss while upper leaves appear green and immature, and (3) apparent necessity to harvest the plant while relatively few leaves appear to be the optimal maturity range. The latter situation makes it extremely difficult to produce a satisfactory cure, even under the best curing management. Indications are that key questions must be addressed before these problems are solved. These questions relate to time and method of plant establishment, environmental conditions and their relationship to growth and maturation, and holding ability (perhaps related to nitrogen metabolism and plant nutrition). Since oriental tobacco has been successfully produced in earlier years in the Piedmont and western parts of North Carolina, there may be merit in relocating these experiments to other research sites.

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NUTRITIONAL AVAILABILITY AND USE DURING SEED GERMINATION

This study was undertaken to examine the effect of the timing of nutritional availability on seedling dry weight accululation. Seeds of cultivar Speight G-28 were first incubated for designated periods in water or liquid nutrient (phytotron's complete medium) followed by transfer to liquid nutrient or water, respectively, for the remainder of the two-week (336 h) period. The following conclusions are drawn on the basis of data shown in Fig. 1:

1. Tobacco seed/seedlings do not need, and cannot use if supplied, fertilizer during the first 48 h of imbibition. There is also no need for the fertilizer during the 48- to 72-h period, although the embryo can use it when supplied.

2. It is undesirable to supply fertilizer during the first 72 h because of osmotic depression of imbibitional physiology. Thus dry weight of seedlings incubated continously in nutrient solution was lower than those incubated for up to 72 h in water followed by the nutrient solution. Similarly, dry weight of seedlings incubated in nutrient solution for up to 72 h, followed by water, was lower than those incubated continuously in water under light or darkness.

3. Nutritional requirement was critical after 144 h, because any delay thereafter of nutrient supply affected growth adversely.

4. Until the appearance of the first foliage leaf (i.e. between 216 to 240 h), available light and fertilization were sufficient to promote net accumulation of dry weight. After this event, however, seedling dry weight progressively decrased, perhaps because the light used favored photorespiration over photosynthesis in the foliage leaf and/or senescense in the cotyledons.

HORMONAL REGULATION OF SEEDLING DEVELOPMENT

This study was undertaken to investigate the effects of exogenous plant growth regulators on the germiation percentage and rate under light or darkness. The experimental approach used consisted of two major steps: (a) determination of the optimally effective concentrations, and (b) continuous or pulse application of the optimal concentrations.

Results from the above study indicate that treatment with gibberellic acid (GA_3) for a period as short as 1.5 h improves germination synchrony considerably. This finding is significant, because in previous years GA_3-treatment was found to be ineffective. This turned out to be realated to concentrations chosen on the basis of published reports. The effective concentration of GA_3, at 1.Ø mM, was found to be considerably higher than Ø.1 mM used for other seeds. Among the other two common growth regulators, IAA inhibited germination percentage whereas kinetin only slightly improved seed performance. Research is underway to detrmine the interactive effects of various growth regulators on the mechanism and regulation of tobacco seed germination.

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LIPID EXTRACTION FROM TOBACCO SEED

Tobacco seeds being rich in oil, this constituent plays a major role in the germination and stress physiology of seedling development. It is therefore essential to conduct matabolic studies involving the lipid constituent. Since complete extraction of lipids depends considerably on the technique and solvents used, this study was udertaken to evaluate various solvents for the extraction of tobacco and lipis. The four extraciton media tested were: CO_2, Chloroform-Methanol-Water (CMW), Hexane-Isopropanol (HI) and Chloroform-Methanol-Hexane (CMH). These solvents have been used from time to time in conjunction with other plant materials.

CO_2 extraction was accomplished with the aid of a commercially procured soxhlet extractor. Extraction with all other solvents were accomplished by first grinding 1.Ø g seed with the respective solvent and then incubating overnight in the same solvent at 25 C. The extraction was carried on for three times with centrifugation between each extraction. Table 1 shows the composition of each solvent mixture and the percentage of lipid based on extraction with the respective solvent. These results clearly show that Chloroform-Methanol-Hexane (CMH) extracts greater amount of lipid with minimum sample variability as compared to other solvents. This is in contrast with the historical use of CMW, and recent increase in the use of HI, because of toxicotogical considerations. Based on the data in Table 1, CMH was selected for tobacco seed-lipid extraction. Studies are in progress with the use of this solvent.

STRESS PHYSIOLOGY

Tobacco seeds are known to remain viable under the soil for many years, althought they pass through repeated cycles of soaking-drying during this period. On the other hand, it is also well known that drying of seeds beyond certain stages of embryonic growth causes irreversible damage and death. Furthermore, drying-soaking has also been used for many other species for invigorating the potentially slow seeds in a given lot. Thus, it appears that for each species under consideration there exists a delicate balance between soaking, drying, and developmental stage with regard to death, survival, and even improved performance. The objective of this study was to develop basic information on these aspects of tobacco seed germination and seedling development.

Seeds were passed through different cycles of drying and soaking following an initial period of soaking which ranged between 24 to 78 h. Preliminary results from this study indicate that soaking-drying, which reportedly improves performance of other seeds, may not be an effective treatment for tobacco seeds. With rspect to viability following repeated drying the 48-h period appeared to be critical in that seeds are viable and produced healthy seedlings as long as the physiological stage did not pass beyond the 48-h period. This was without regard to the number of soaking-drying cycles within this period.

II. GRADUATE STUDENTS:

1. Mohamed El-Dodo - Hormonal regulation of tobacco seedling development.

III. POSTDOCTRAL FELLOWS: None

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IV. PUBLICATIONS:

1. Arcila, J. and S. C. Mohapatra. Development of tobacco seedling. 2. Morphogenesis during radicle protrusion. Tob. Sci. 27:34-40.

2. Arcila J. and S. C. Mohapatra. Development of tobacco seedling. 3. Morphogenesis during plumule emergence and post-emergence development. Tob. Sci. 27:112-115.

V. MANUSCRIPTS ACCEPTED FOR PUBLICATION: Nil

IV. MANUSCRIPTS IN REVIEW:

1. Chakrabarti, S. M., C. S. Chang, and W. H. Johnson. Thermal conductivity of cured tobacco shreds in moist, frozen, and freeze-dried states.

2. Johnson, W. H. and C. S Chang. Development of a cross-flow modular curing system.

3. Johnson, W. H. Solar curing and heat recycling in tobacco curing.

4. Mohapatra, S. C. and W. H. Johnson. Measurement of whole-seed respiration through dissolved oxygen polarography.

5. Mohapatra, S. C., J. Arcila, W. H. Johnson and L. A. Nelson. Improvement of germination synchrony of tobacco seeds through dark preincubation treatment.

6. Mohapatra, S. C. and W. H. Johnson. A thermogradient incubator for seed germination studies.

VII. PAPERS PRESENTED AT PROFESSIONAL MEETINGS:

1. Arcila, J. and S. C. Mohapatra. Nucleic acid metabolism during tobacco seed germination. Annual Meeting, Amer. Soc. Plant Physiol., Colorado State University, Ft. Collins, CO, Aug. 7-11; Plant Physiol. 72(s):99.

2. Yang, C. C. and W. H. Johnson. Design simulation of a multi-barn tobacco curing system. 1983. Winter Meeting of ASAE, Chicago, IL, Dec. 13-16, 1983.

VIII. GRADUATE STUDENT THESIS COMPLETED: NIL

IX. ACKNOWLEDGEMENTS:

Research conducted during the reporting period was partially funded by the Philip Morris Co, Richmond VA. Technical assistance for results discussed in this report were provided by S. M. Leary, Sidney Bland, Bill Barney and Mohamed El-Dodo.

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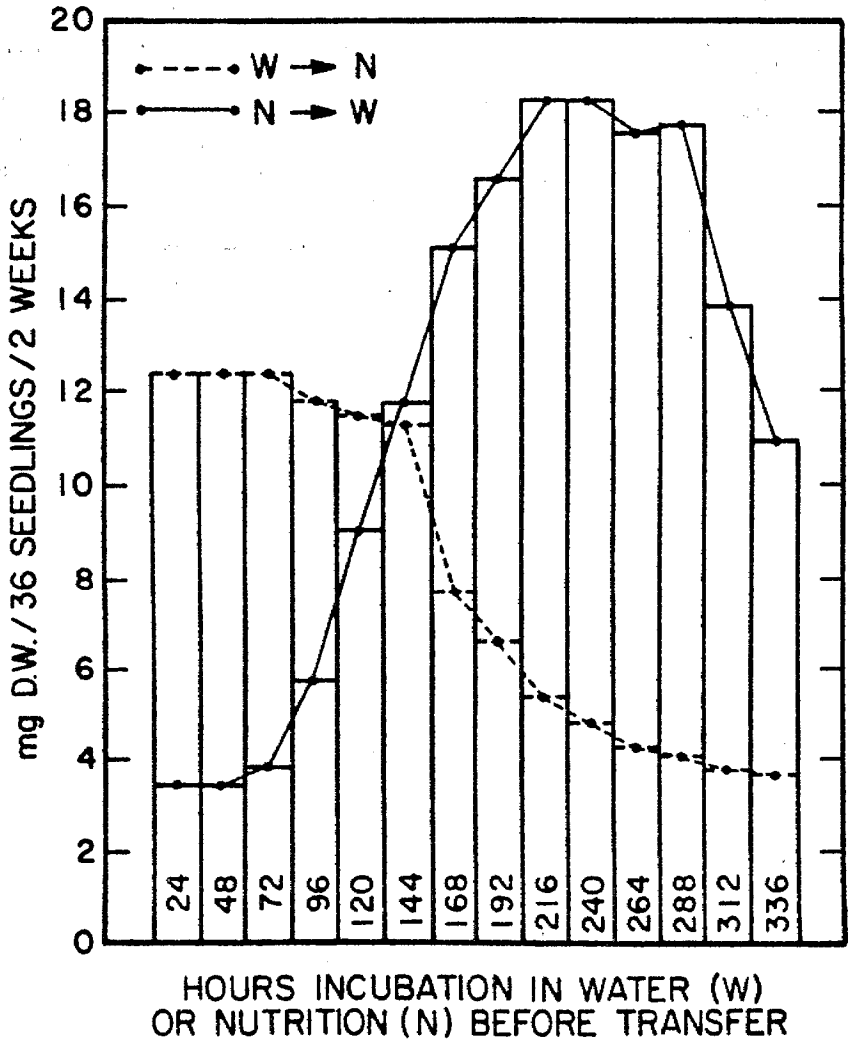

Figure 1. Effect of delayed supply (- - -) and early withdrawal (——) of nutrients on tobacco seedling dry weight at the end of 2-weeks. Controls were 2-week continuous incubation in deionized water or nutrient medium.

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TABLE 1. Effect of various solvents on tobacco seed-lipid extractability

SOLVENTS	PERCENT LIPID
CO_2	29.7 ± 3.09
C-M-W (1:2:0.8)	36.8 ± 2.20
H-I (3:2)	26.4 ± 5.64
C-M-H (4.1:1:2.6)	41.3 ± 1.61

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NC Ø2136: OPTIMIZATION OF TOBACCO CURING SYSTEMS

W. H. JOHNSON, Project Leader

I. SUMMARY OF RESEARCH (1983-84):

ENERGY REDUCTION IN A MULTI-BARN CURING SYSTEM

Curing management of process conditions offers considerable potential for energy savings in the multi-barn curing system, under development and test at the Oxford Tobacco Research Station since 1979. It has long been recognized that excess ventilation during either day or night conditions is energy wasteful. On the other hand, with this system, which utilizes both heat recycling and solar energy, solar energy collection is functionally dependent on air flow through the collector. For this reason a management schedule was devised such that the exchange air rate was increased during the day to maximize usage of available solar energy. Nine tests were conducted during 1983, between August 1Ø and September 23, to provide further operational data for this schedule, which was also tested during the 1982 season.

Table 1 shows certain results for the 1983 tests. Because of the high correlation between enery use and water removed, the data are presented for energy use per unit water loss. This is a more realistic measure than energy use per unit cured weight, since moisture content of tobacco varies considerably among years and leaf position on the stalk. Results showed that fuel and electricity supplied 2.Ø1 and Ø.66 MJ/kg-water, respectively. Total energy consumption (2.67 MJ/kg-water) was higher than those for 1981 and 1982, i.e. 2.51 and 2.38 MJ/kg-water, respectively. A computer analysis showed that energy use was excessive due to overventilation in 1983. A higher wet bulb temperature during the drying phase would predictably reduce over-ventilation and energy use. The data further suggest that partial drying during the yellowing phase is advantageous to minimizing energy use.

EFFECT OF WET BULB CONDITIONS DURING CURING

Researchers and farmers have long sought to answer the question, "What conditions are best for yellowing and drying tobacco, insofar as wet bulb is concerned?" Energy requirement appears less when high wet bulb temperatures are used, however, these conditions likely increase leaf temperatures and respiratiory weight losses. Tests were initiated in 1983 to provide quantitative data and having objectives of: (1) determining the effect of wet bulb conditions (with constant drying potential during yellowing) on energy use, (2) determining the effect of wet bulb conditions on dry matter, respiratory losses, and (3) determining optimal conditions for achieving maximum economic return to the farmers.

Studies were initiated at the Oxford Tobacco Research Station in 1983, utilizing three small curing chambers equipped with weight and temperature instrumentation. Three curing regimes were tested for the yellowing phase (1) 9Ø°F d.b. -- 85°F w.b.; (2) 1ØØ°F d.b. -- 96.Ø°F w.b.; and (3) 11Ø°F d.b. -- 1Ø6.8°F. -w.b. Following yellowing, the leaf drying schedules for temperature were the same; however, wet bulbs were increased slightly if necessary to permit elevation of dry bulb temperature.

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While results are incomplete in regards to respiratory losses, the data does show that energy use was higher for the lower wet bulb conditions; however, total value was higher for the cured product at these conditions. This suggests that higher wet bulb conditions, while reducing energy usage, may reduce overall value of the cured product.

CURING UNDER MODIFIED ATMOSPHERES
(In cooperation with R. E. Williamson)

Tests were initiated in 1981 to study various chemical conversions under controlled atmosphere conditions, to determine methods for reducing dry matter loss, and to investigate potentials for reducing curing time. The tests of 1982 have previously been reported in detail; therefore, procedures will not be repeated here for 1983. The purpose of the work in 1983 was to provide additional tests with slightly modified sample preparation and sampling time to permit better gaseous flow through the tobacco and more complete yellowing.

No results are available at this time on chemical conversion under modified atmospheres. When available these data should be meaningful in elucidating the importance of atmospheric oxygen to various processes occurring during the yellowing phase of tobacco curing.

CURING STUDIES ON BURLEY TOBACCO
(In cooperation with R. E. Williamson)

During 1982, research was initiated to obtain comprehensive data on chemical conversions in burley leaf during air curing and bulk forced-air curing conditions. Kentucky 14 variety was produced at the Mountain Research Station, Waynesville, North Carolina for the study. A portion of the tobacco was whole-plant air cured at Waynesville for a control, while the remainder was transported to Oxford, N. C. for curing.

Results of the 1982 tests showed that normally air-cured tobacco at Waynesville was adjudged to be of slightly higher quality than tobacco air cured or heat cured at Oxford. Value per acre was higher, however, for the heat cured tobacco due to higher cured weights.

In order to more completely evaluate the potential for bulk curing of primed or whole-plant burley tobacco, the tests were continued in 1983 having objectives: (1) to identify on the basis of chemical and physical properties those requisite conditions for producing high quality leaf, and (2) to conduct studies which lead to development of a low-cost forced-air curing system for burley tobacco, which reduces labor and improves quality.

As in 1982, burley tobacco was produced at Waynesville with a portion (on and off-the-stalk) air cured at Waynesville to serve as controls while the remainder was transported to Oxford, N. C for curing trials there. Oxford treatments included air curing of whole-plant, air curing of stripped leaves on sticks, and bulk curing of whole plants (in special chamber), leaves strung onto sticks, and leaves cured on racks.

Evaluations are currently in progress to obtain various leaf and smoking properties for these treatments. It is of interest that the curing treatments at Oxford produced even more serious effects on yield and value per acre than noted previously. For some unexplained reason all five treatments at Oxford

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gave reduced yields, ranging from about 200 to 600 lb/acre. Furthermore, total value per acre was even more seriously affected due to quality losses. A complete examination of process conditions for curing is suggested to seek an explanation to these results.

II - VIII. See 1983-84 report for NC 03801.

IX. ACKNOWLEDGEMENTS:

Research conducted during this reporting period was partially funded by the N. C. Tobacco Foundation, Inc. Technical assistance for results discussed in this report was provided by Dr. C. C. Yang, Mr. S. M. Leary and Mr. Sidney Bland.

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TABLE 1. Energy requirements for the Oxford multi-barn solar curing system (1983).

Test	Date Test Started	Green Weight (kg)	Moisture Content (%d.b.)	Cured Weight (kg) [1]	Water Loss (kg)	Electricity (MJ/kg-water)	Natural Gas [2] (MJ/kg-water)
1	8-10-83	2670	730	325	2345	0.62	2.03
2	8-12-83	2645	801	338	2307	0.56	2.15
3	8-22-83	1916	860	264	1652	0.56	1.89
4	8-24-83	2386	864	315	2071	0.59	2.18
5	8-26-83	2382	830	350	2032	0.70	1.69
6	9-12-83	1825	507	332	1493	0.77	2.15
7	9-16-83	2286	465	423	1863	0.75	2.18
8	9-22-83	2323	402	488	1835	0.61	2.54
9	9-23-83	1859	421	346	1513	0.78	1.71
Avg.					1957	0.66	2.01

[1] Weight when removed from barn

[2] Based on BTU factor of 1,033 BTU/ft^3 for August 1983 and 1,037 BTU/ft^3 for September 1983.

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NC 03804 MECHANIZATION OF TOBACCO PRODUCTION

C.W. Suggs, Project Leader
R.W. Watkins, Project Co-Leader

I. Summary of Research:

A. Tractor Mounted "Last Over" Harvester

This harvester, conceived and developed as a low-cost efficient machine for removal of the 8 to 12 top leaves, has been discussed in earlier volumes of this report. During the summer of 1983 an outboard wheel was added on the right side to support the overhung weight of the harvester and the tongue weight of the trailer which carries the harvested leaf, Fig. 1. The wheel was powered by means of a hydraulic motor in order to overcome its own rolling resistance and to provide drawbar pull for the trailer. Speed synchrony between the outboard wheel and the tractor was provided by means of a rotary valve which passed a fixed volume of hydraulic fluid per revolution of the valve shaft. A disk on the valve shaft was pressed against the right rear tractor tire to drive the valve at a constant speed ratio with respect to ground travel.

The outboard wheel worked well in supporting the offset weight of the harvester allowing the machine to run level. Sidedraft from the towed leaf storage trailer was almost eliminated by the hydraulic drive feature of the wheel. Development of the powered outboard wheel allows the last over harvester to be used on the small tractors typically found on tobacco farms.

B. Wood Chip Stoker

Development has continued on the wood burning furnace discussed in the earlier volumes of this report. A wood chip stoker was added to the previously cord wood fired furnace in 1982. Wood chips burned well in the furnace and creosote formation was practically eliminated by the continuous rather than batch feeding and the fact that wood in excess of the combustion air supply is not present.

There were problems with the wood chips jamming the auger and shearing the drive pins. In 1983 this problem was solved by cutting teeth into the auger and the end of the feed tube, Fig. 2, so that any chips not between the auger flights would be torn and sheared by these teeth as the chips entered the feed tube. Also, any discontinuities or side chambers in the feed tube were removed so the chips would not be obstructed in the tube.

In the event that a blockage did occur a circuit was developed to reverse the auger drive motor for a few seconds to allow the blockage to fall out before restarting in the forward direction.

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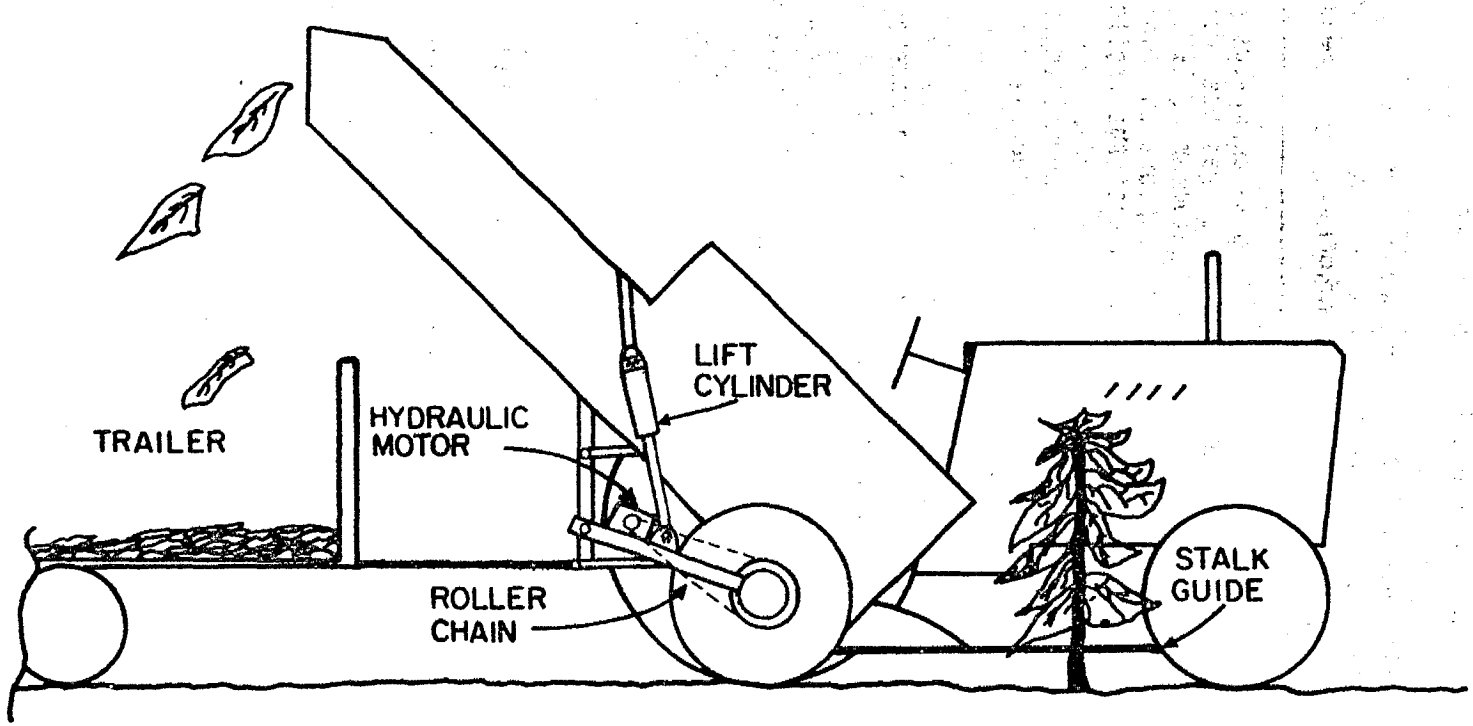

Fig. 1. Powered outboard wheel was added to carry overhung weight so harvester could be carried by a small tractor.

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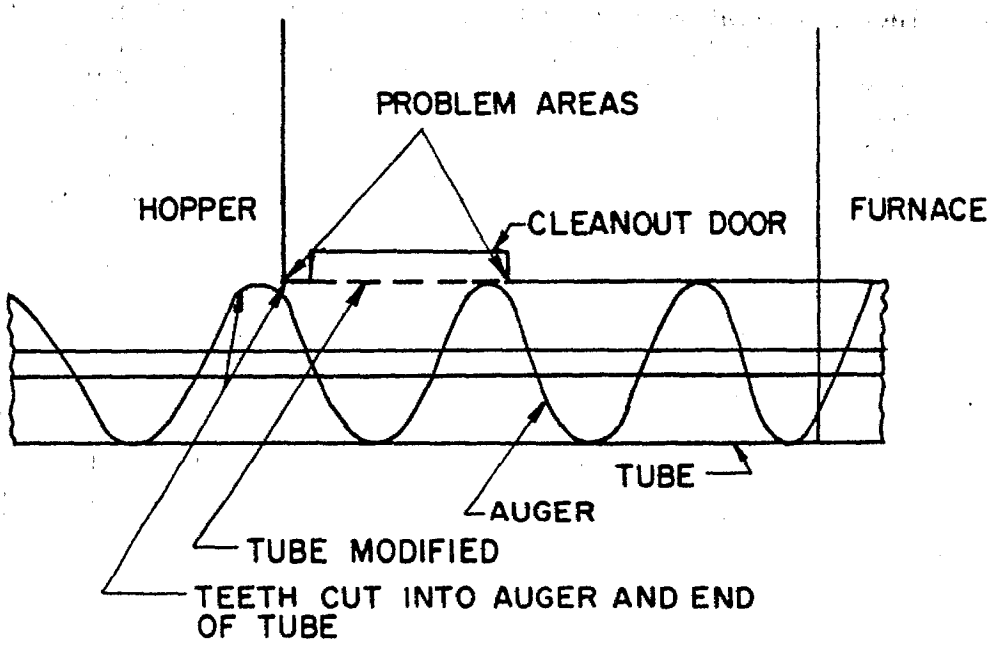

Fig. 2. Offsets in auger tube were eliminated and teeth were cut in the end of tube and adjacent auger section to reduce chip jamming.

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This involved mounting the drive motor in a cradle and restraining its rotation with a torque arm acting against a spring, Fig. 3. During a blockage the motor torque increases and trips the switch initiating a change in motor direction.

The stoker with these two improvements operated an entire season of 5 cures without shearing any drive pins.

C. Resistance of Wood Chips to Air Flow

Wood chips are attractive as fuel for curing tobacco because they can be harvested mechanically, limbs and tops can be utilized, and the resulting material can be handled and fed into the furnace automatically. Wood is normally chipped green because the chipper blades are rapidly dulled on dry wood. Moisture content of green chips typically runs from 35 to 55% wet basis (Riley, et al., 1983). Green chips are difficult to burn and high moisture chips support fungal growth which causes allergic reactions in some people. Also, frozen chips with moisture contents above 40% adhere to one another and are very difficult to feed (Riley, et al., 1983).

Piles of green wood chips dry very slowly under natural ventilation and if not protected from the rain may actually show an increase in moisture content (Curtis, 1980). Chips can, of course, be dried with natural or heated air provided the air is forced through the chips with a suitable fan. Moisture content decreases in the center of an uncovered pile but increases on the surface yielding a significant increase in total moisture content.

The objective of this work was to evaluate the air flow characteristics of various depths of wood chips when exposed to several air pressure input levels.

Air flow was measured with the same equipment, with minor modifications, which Abrams and Fish (1982) used to measure air flow through sweet potatoes. It consisted of an 89 cm x 89 cm x 58 cm high plenum onto which up to five 61 cm x 61 cm x 41 cm column sections could be added. Expanded metal with a 3.8 cm x 7.6 cm mesh was used to cover the plenum outlet to keep chips from falling into the plenum. A 75 watt 1570 rpm squirrel cage blower was attached to the plenum through a sliding gate valve with six approximately equal opening increments.

An empty column section fitted with a 3.2 mm thick plate containing a 12.7 cm diameter orifice was used on the top of the column to produce a pressure drop from which flow could be determined. Pressure taps were located 5 cm below the mesh level in the plenum and 5 cm below the orifice level at the top of the column. The pressure difference measured between these two taps was the pressure across the column of chips, and the pressure measured from the upper tap to the

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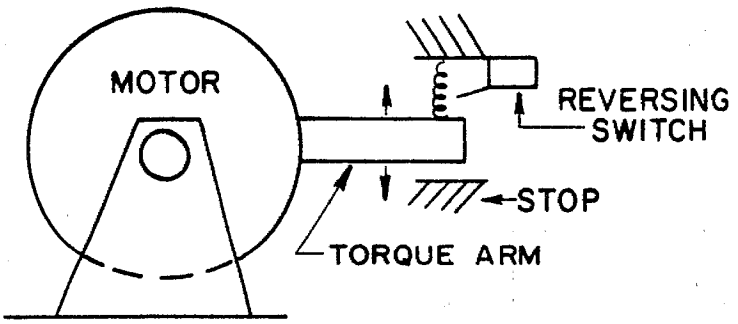

Fig. 3. Cradle mounting of stoker motor with torque arm to sense load and actuate reversing switch.

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atmosphere was the pressure across the orifice. Pressures were measured in terms of water column with a Dwyer Microtector TM Portable Electronic Hook Gage which had an accuracy of ± 0.062 Pa.

Flow through the medium size chips, Fig. 4, exhibited the typical Shedd response (Shedd; 1953) in which superficial velocity is plotted against the pressure gradient on a log-log scale. The response had a slope of 0.5352, a unity intercept (when Pa/m equals one) of 0.0220 and a correlation coefficient (r value) of 0.99, Table 1. The depth effect was essentially normalized, as expected, by division of the pressure by column height. That is, flow resistance is proportional to bed depth. The flow response for green chips was similar to dry chips with a slope of 0.6448, a unity intercept of 0.008175 and a correlation coefficient of 0.9957.

Air flow at a given input pressure gradient increased as the chip particle size increased. This is consistent with the literature in which large particles such as ear corn has less resistance to flow than small particles such as shelled corn or clover seed. Results of higher pressure air flow through wood chips from Kimball (1975) have been included in Fig. 4 for comparison with our results.

Table 1. Air flow characteristics of wood chips. Slope of regression line, unity intercept and correlation coefficient (r). $Q = aP^b$

	Intercept, a	Slope, b	r
Dry chips	0.0119	0.6304	0.9685
Green chips	0.0082	0.6448	0.9957
Large chips	0.0295	0.5204	0.9994
Medium chips	0.0220	0.5352	0.9998
Small chips	0.0124	0.6169	0.9997

D. Burley Mechanization

Research was undertaken on two of the most labor intensive operations in burley production, namely harvesting and handling. Field investigations of harvesting over two years at the Mountain Research Station has shown that, depending on season, modest increases in crop value can be realized by priming the lower 1/4 of the leaves followed by stalk harvesting approximately two weeks later, Table 2. It was also demonstrated that the mechanical harvester developed for flue cured can successfully prime burley, especially the lower leaves.

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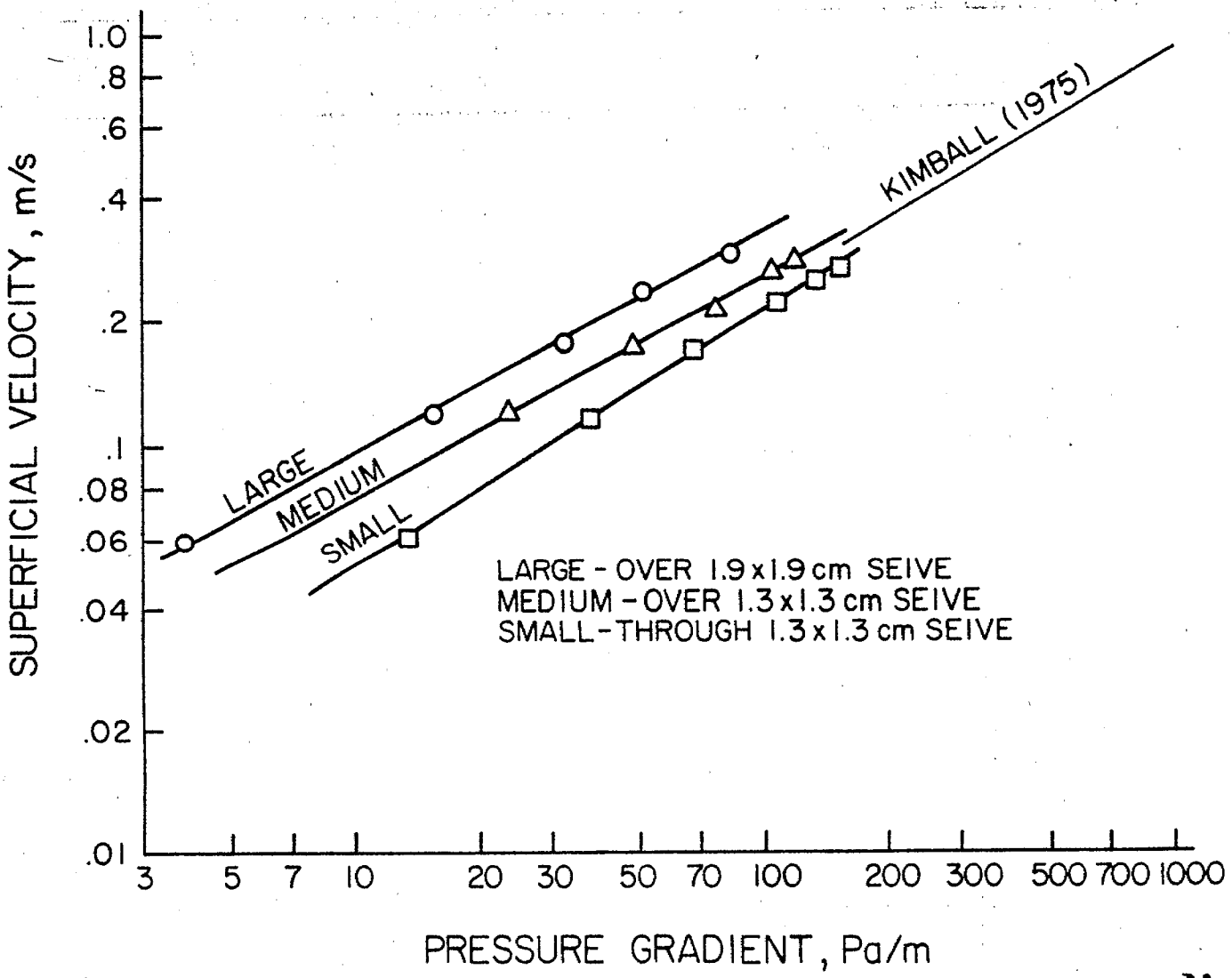

Fig. 4. Air Flow Characteristics of Small, Medium and Large Wood Chips.

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A device to lift sticks of burley into the curing barn was designed, constructed and tested. There was some space interference between the lift and the workman who took the stick from the lift and placed it on the tier rails. Design improvements are being considered.

Table 2. Effect of priming on burley crop value.

Trt	Primed	Stalk Cut	Prime Schedule	Cut Schedule	1982 Value $/A	1983 Value $/A
1	0	4/4	-	Optimum	5809	4901
2	1/4	3/4	Optimum	Optimum	6063	5146
3	2/4	2/4	Optimum	Optimum	5855	4998
4	3/4	1/4	Optimum	Optimum	5724	5114
5	4/4	0	Optimum	-	5053	-
6	1/4	3/4	Immature	Optimum	6037	5138
7	2/4	2/4	Immature	Optimum	5712	5401
8	1/4	3/4	Overmature	Optimum	5316	4784
9	2/4	2/4	Overmature	Optimum	5835	5188
10	0	4/4	-	Overmature	5432	-

E. Air Flow Through Curing Boxes

Adequate air flow through the curing barn is essential to good cured leaf quality. While air flows through racks and boxes of tobacco have been measured; the effects of input air pressure, container depth and packing density have not been quantified. In the present study a curing box was filled with tobacco, sealed with plastic film on the four vertical sides and left open on the top and bottom. An input plenum was attached to the bottom and an output plenum and orifice plate was attached to the top. A variable speed fan forced air into the lower plenum, up through the tobacco and out through the orifice plate. Pressure was measured with a micromanometer about 1 inch below the tobacco and 1 inch below the orifice plate.

Flow was calculated from the orifice plate pressure and diameter and plotted as volume per unit of box cross section versus the input pressure per unit of crop depth, Fig. 5. After measuring pressures over the full range of fan speeds, a saw cut was made through the tobacco about 1/4 of the way down from the top of the box. All the leaf above this cut was removed and another set of pressure readings were made for the reduced leaf depth. Similar readings were made for 1/2 and 1/4 of full load depths.

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The results, Fig. 5, indicated that flow increases with increases in input pressure and that on a log-log plot the response gives a straight line. This is the expected classical response. In crops such as grain and seed which are relatively noncompressible the effects of depth are removed by dividing the input pressure by bed depth. This is clearly not the case with tobacco where the effects of depth are clearly visible even after the pressure has been divided by depth. It is likely that the lower part of the curing container was packed more densely than the top. The effect of packing density on flow will be studied during the 1984 season.

Literature Cited

Riley, J.G., N. Smith and C.S. Drechsel. 1983. Drying and storage of woody biomass fuels. ASAE Paper # 83-3560.

Abrams, C.F., Jr. and J.D. Fish. 1982. Air flow resistance characteristics of bulk piled sweet potatoes. Trans. of ASAE 25(4):1103-1106.

Curtis, M.L. 1980. The effect of outside storage on the fuel potential of green hardwood residues. M.S. Thesis. Virginia Polytechnic Institute and State Univ., Blacksburg, VA.

Shedd, C.K. 1953. Resistance of grains and seeds to air flow. Agri. Engr. 34(9):616-619.

Wilhelm, L.R., F.D. Tompkins and C.A. Mullins. 1983. Air flow resistance of bean and pea pods. Trans. of ASAE 26:946-949.

V. Manuscripts Accepted for Publication:

Suggs, C.W. Mechanical harvesting of flue cured tobacco. Part 14. Properties of green and dry stalks. Tob. Sci.

Maw, B.W. and C.W. Suggs. Mechanization of transplanting. Part 1. Sorting and selection of bare root transplants. Trans. of ASAE.

VI. Manuscripts in Review:

Suggs, C.W. Wood chip stoker and furnace for curing tobacco. Submitted to Trans. of ASAE.

Suggs, C.W. Mechanical harvesting of flue cured tobacco. Part 15. Design and evaluation of a low clearance tractor mounted "last over" tobacco harvester. Submitted to Tob. Sci.

Suggs, C.W. Resistance of wood chips to air flow.

VII. Papers Presented at Professional Meetings:

Suggs, C.W. and B.W. Maw. Mechanized seedling harvester. ASAE Paper # 83-3051, 1983.

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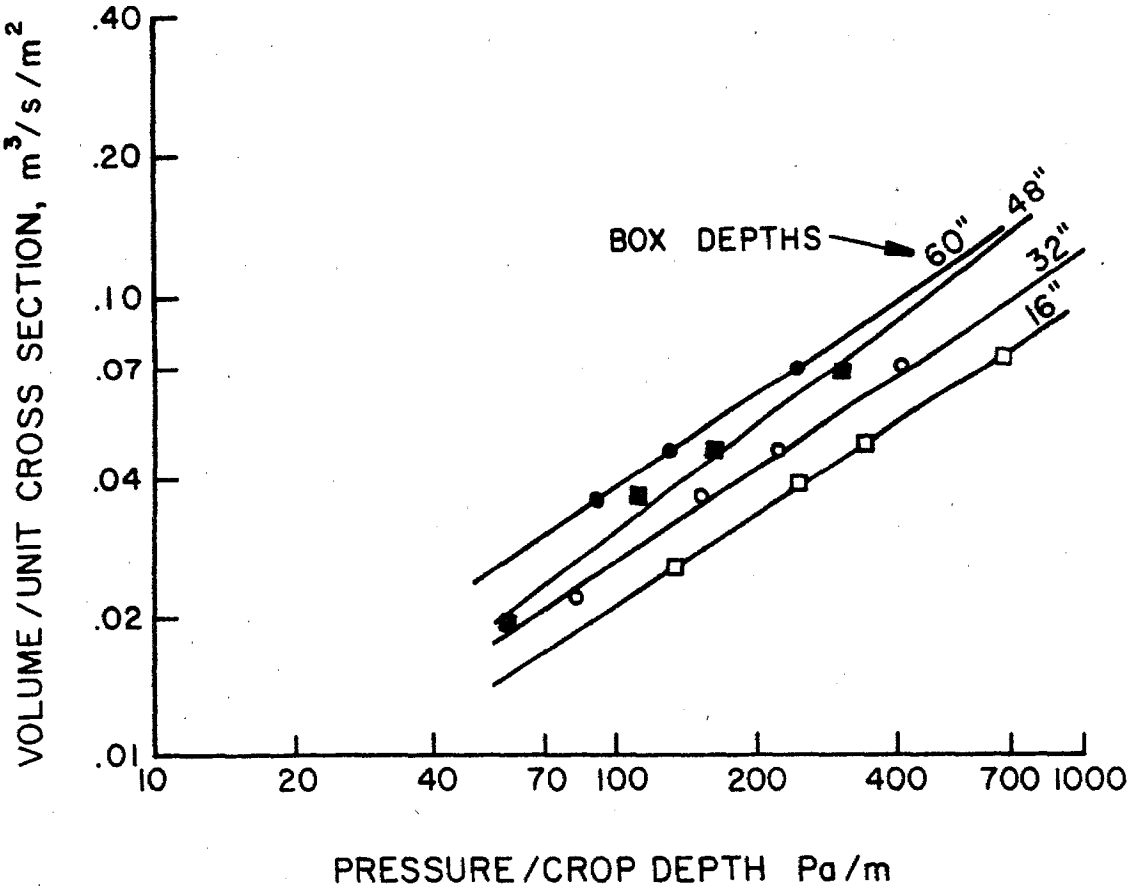

Fig. 5. Air flow characteristics of tobacco in curing boxes.

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NC Ø2124: DEVELOPMENT OF INSTRUMENTATION TO MEASURE QUALITY AND COMPOSITION OF TOBACCO

W.F. MCCLURE, Project Leader

Cooperators: W. W. Weeks, Crop Science
Ralph E. Williamson, USDA
F. G. Giesbrecht, Statistics

I. SUMMARY OF RESEARCH

The gravimetric method is still the most widely used method for determining the water content of soils. However, it often takes hours to make gravimetric determinations making the method undesirable for field measurements. Over the years researchers have developed electronic instruments for measuring moisture in soils and other materials (1-12). Each of the instruments developed have certain limitations and anomalies which have prevented the establishment of a standard electronic instrument. Consequently work continues to search for a method and instrument which would provide reliable field measurements of soil moisture.

Researchers have shown that the near infrared reflectance spectra of products contain sufficient information to estimate water content (4,10,13,14). Little work has been done to reduce this technology to portable instrumentation for field measurements of soil moisture. The thrust of the research reported in this paper was to develop a near infrared soil moisture meter. The design and performance of this instrument is discussed in the following paragraphs.

THEORY

Typical NIR spectra of dry (D) and wet (W) soil samples in the region of a water absorption band is shown in Fig. 1. Water typically has absorption bands at 1.2, 1.45, and 1.94 micrometer (μm) in the NIR region. The established method for measuring moisture by the NIR method is to measure the intensity of the absorption band (at λ_2) and at a reference point λ_1. Note that curve D, having zero water content, has no water absorption band like curve W. The intensities $\nu_{\lambda 1}$ and $\nu_{\lambda 2}(n)$ at points λ_1 and λ_2 are shown as follows,

$$\nu_{\lambda 1}(n) = C_1 - f_{\lambda 1}(n)$$
$$\nu_{\lambda 2}(n) = C_2 - f_{\lambda 2}(n) - \omega_{\lambda 2}(n) \qquad [1]$$

Where C_1, C_2 = the reflectance intensity at λ_1 and λ_2 respectively when there is no water content; $f_{\lambda 1}(n)$, $f_{\lambda 2}(n)$ = the difference between the two curves due to a change in the index of refraction caused by water in sample w; $\omega_{\lambda 2}(n)$ = the change in curve w due to presence of water; n = % of water content.

When the refernce wavelength λ, is selected near of λ_2, i.e. $\lambda_1 = \lambda_2$, then

$$f_{\lambda 1}(n) = f_{\lambda 2}(n), \text{ and } C_1 = C_2 \qquad [2]$$

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The difference $\nu(n)$ between $\nu_{\lambda 1}(n)$ and $\nu_{\lambda 2}(n)$ may be written as

$$\nu(n) = \nu_{\lambda 1}(n) - \nu_{\lambda 2}(n)$$
$$= \omega_{\lambda 2}(n). \qquad [3]$$

This $\nu(n)$, that is the water absorption $\omega_{\lambda 2}(n)$, is proportional to the water content but the values of these terms in the equation [1] depends on the kind of soil. To compensate for different kinds of the soil, the ratio R(n) of (n) to $\nu_{\lambda 1}(n)$ is adapted; that is, the ratio of the value of water absorption $\omega_{\lambda 2}(n)$ to the reference value of $\nu_{\lambda 1}(n)$ is used. Hence,

$$R(n) = (n)/\nu_{\lambda 2}(n) = \omega_{\lambda 2}(n)/\nu_{\lambda 1}(n) \qquad [4]$$

NIR SPECTRA

The NIR spectra of clay and loam with varying amounts of water are shown in Figs. 2 and 3. Note that the spectra has been normalized at 1.8 μm, the references wavelength of the NIR meter. Both clay and loam have similar spectra with the exception of clay absorption in the region of 1.2 μm. Selection of the reference wavelength at 1.8 m was based on visual obsevation of the spectra and prior work on other products (15).

DESIGN

The physical design of the NIR moisture meter is shown in Fig. 4 (a), (b). The entire meter, including the power supply, can be housed in an aluminum tube 1.5" diameter and 15.0" long. However, data reported in this paper was acquired with the circuitry outside the tube.

The lower end of the tube constitutes an integrating cylinder which reflects the diffuse energy from the sample onto the PbS detectors. Two filters isolate the measuring band at 1.94 μm and the reference band at 1.80 μm. PbS detectors are mounted to a thick piece of aluminum which serves as a heat sink to keep the two detectors at the same temperature. Wires connecting the power supply to the lamp and from the PbS detectors to the circuitry pass through holes in the heat sink. Both ends of the tube were sealed and a drying agent (Silica Gel) was inserted to keep the moisture inside the tube at a minimum.

A simplified diagram of the electronic circuitry is given in Fig. 5 and a detailed diagram in Fig. 6. Note that the detectors are mounted in bridge circuits in order to be able to adjust the dark current to zero. With the quartz glass of the tube pressed against a soil sample (Fig. 4), the output of the preamplifiers A_1, both having the same gain, represent the reference (at 1.80 μm) and measuring at 1.94 μm signals. The two signals are multiplexed to a common amplifier A_2 and demultiplexed for filtering using analog switches and a two phase oscillator (see Fig. 6). The two outputs of the same low-pass filter (L.P.F.) represent $A\nu_{\lambda 1}(n)$ and $A\nu_{\lambda 2}(n)$, where A is the total amplitude. The output $A\nu_{\lambda 2}(in)$ is fed back to A_2 to keep the reference output constant. Hence,

$$A\nu_{\lambda 1}(n) = C - (\text{const.}) \qquad [5]$$

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The output of the meter $v_o(n)$ is determined by the difference amplifier A_3.

$$v_o(n) = Av_{\lambda 1}(n) - Av_{\lambda 2}(n)$$

Using the equation [3]

$$v_o(n) = A\omega_{\lambda 2}(n) \qquad [6]$$

From the equations [5] and [6]

$$v_o(n) = C\omega_{\lambda\ 2}(n)/v_{\lambda 1}(n) \qquad [7]$$

Since C is constant, the output voltage $v_o(n)$ expresses the same ratio with the R(n) in the equation [4] multiplied by C. The offset voltage that comes from the characteristics of soil and the electric circuit is adjusted at the difference amplifier A_3.

PERFORMANCE

Response of the NIR meter to moisture in clay and loam is shown in Fig. 7. While the curves are not congruent, the results are encouraging and suitable for field measurements. The response is linear from 2.5 to 35% moisture. If the meter were used to measure clay and loam from one calibration one may expect a standard error of $\pm$ 1.9% moisture units. In this case the regression is expressed by

$$Y = -0.0276 + 0.0116X$$

and correlation coefficient r is

$$r = 0.9906.$$

Preliminary work does indicate that the meter may require a different calibration for sand and sandy loam. However, data from spectra indicates that additional filters may provide sufficient correction for field measurements of several soil types with only one calibration curve.

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REFERENCES

1. Ulaby, F. T. 1974. Radar measurement of soil moisture content. IEEE TRANSACTIONS on Antennas and Propagation. AP-22(2):257-265.

2. Gates, D. M. 1964. Characteristics of soil and vegetated surfaces to reflected and emitted radiation. In Proc. 3rd. Int. Symp. Remote Sensing of Environment.

3. Topp, G. C., Davis, J. L. and Annan. 198Ø. Electromagnetic determination of soil water content: Measurements in Coaxial Transmission Lines. Water Resources Research 16(3):574-582.

4. Finney, Jr., E. E. and Norris, K. H. 1978. Determination of Moisture in Corn Kernels by Near-Infrared Transmittance Measurements. TRANSACTIONS of the ASAE, 21(1):581-584.

5. Williams, T. H. L. 198Ø. An automatic electrical resistance soil-moisture measuring system. J. Of Hydrology 46(26):385-59Ø.

6. Nagy, A. Z. and Razga, T. 1966. Radioisotopic combined moisture-density meter. J. Sci. Instrum. 43(1):383-387.

7. Rhoades, J. D., Raats, P. A. C. and Prather, R. J. 1976. Effects of liquid-phase electrical conductivity, water content, and surface conductivity on bulk soil electrical conductivity. Soil Sci. Soc. Am. J. 4Ø(4):651-655.

8. Fetzer, W. R. 1954. Some anomalies in the determination of moisture. Agri. Eng. 35(3):173-175, 178.

9. Gupta, S. C. and Hanks, R. J. 1972. Influence of water content on electrical conductivity of the soil. Soil Sci. Soc. Am. Proc. 36;855-857.

1Ø. Harbert, F. C., Sjoberg, B. and Bak, J. 1974. Measuring moisture content on-line by infrared method. Control & Instrumentation 23(1):36-37.

11. Bouyoucos, G. J. and Mick, A. H. 1947. Improvements in plaster of paris absorption block electrical resistance method for measuring soil moisture under field conditions. Soil Sci. 63(3):455-465.

12. Colman, E. A. and Hendrix, T. M. 1949. The fiberglass electrical resistance soil moisture instrument. Soil Sci. 67(3):425-438.

13. McClure, W. F. and Hamid, A. 198Ø. Rapid NIR measurement of the chemical composition of foods and food products: Part I, Hardware. American Laboratory 12(9):57-69.

14. Hamid, A., McClure, W. F. and Whitaker, T. B. 1981. NIR analysis of food products: Part II, Stepwise Linear regression in memory-limited environments. American Laboratory 13(3):1Ø8-121.

15. Beutler, A. J. 1965. An infrared backscatter moisture gage. Tappi 48(9):49Ø-493.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

II. VISITING SCHOLAR:

Dr. Yoshio Kano, Visiting Associate Professor. Department of Electricl Engineering Tokyo University of Agriculture and Technology Tokyo, Japan.

Area of Research: Development of Instrumentation for Measuring Soil Moisture.

III. MANUSCRIPTS ACCEPTED FOR PUBLICATION:

1. McClure, W. F. 1983. Fourier Analysis Enhances Diffuse Reflectance Spectroscopy. Applied Spectroscopy.

2. McClure, W. F., W. E. Ballinger, and E. P. Maness. 1983. Computerized Spectrophotometric Analysis of Blueberries. American Laboratory.

IV. PAPERS PRESENTED AT PROFESSIONAL MEETINGS

1. McClure, W. F. 1983. Robotics in Japan. A Challenge for the American Agricultural Engineer. International Conference on Robotics. Tampa, Florida.

2. McClure, W. F. 1983. Fourier analysis of NIR Spectra. LABCON-83. Chicago, Illinois.

3. McClure, W. F. 1983. Robots in Agriculture. North Carolina Secion of ASAE.

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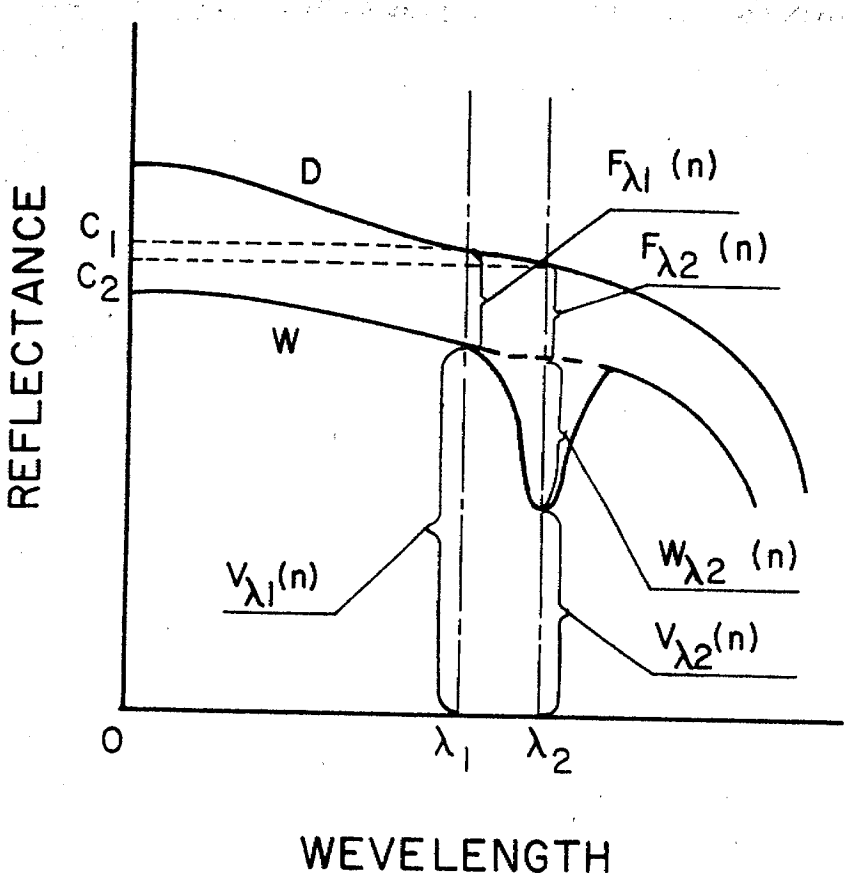

Figure 1. General spectral characteristics of reflectance of soil.

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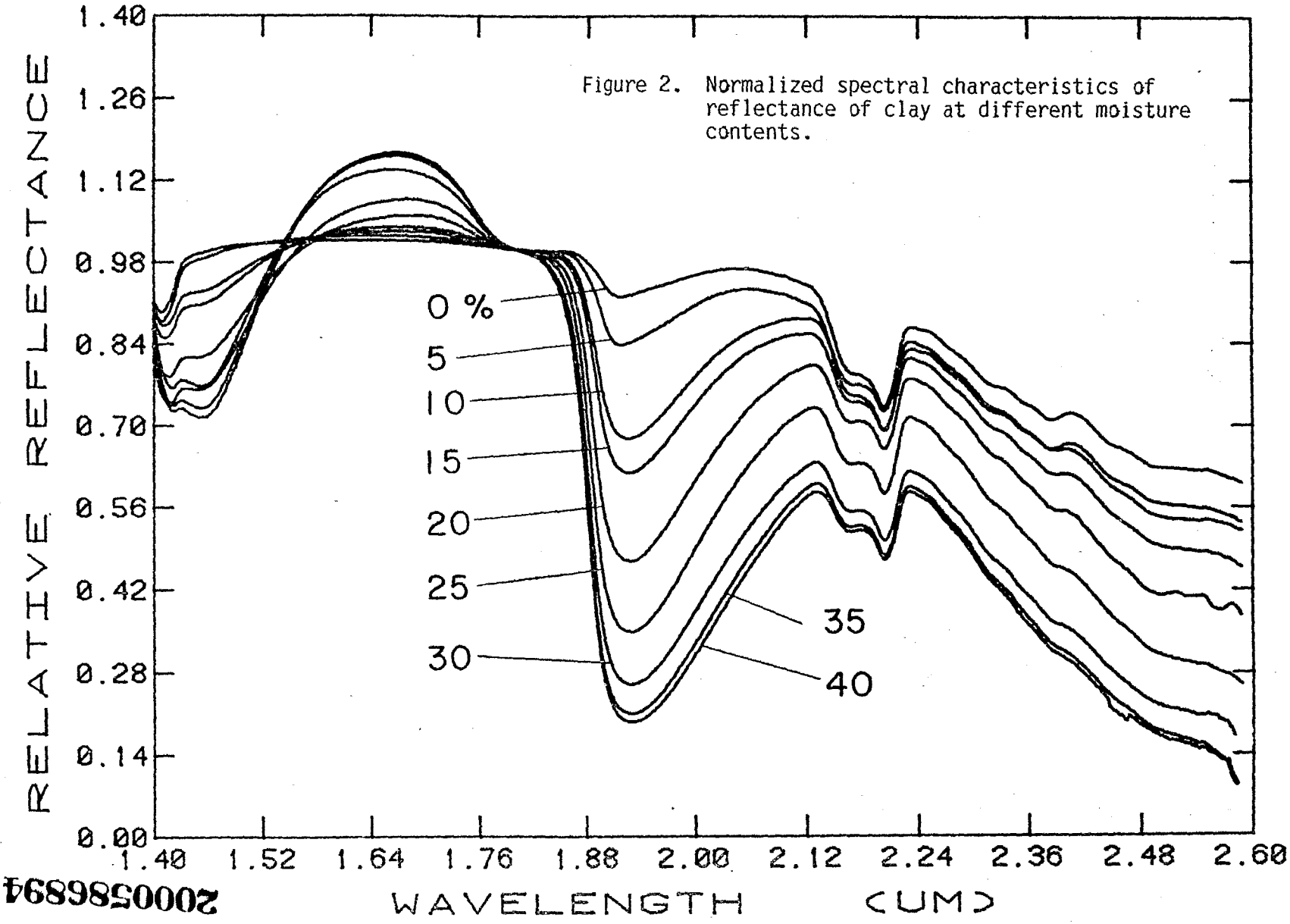

Figure 2. Normalized spectral characteristics of reflectance of clay at different moisture contents.

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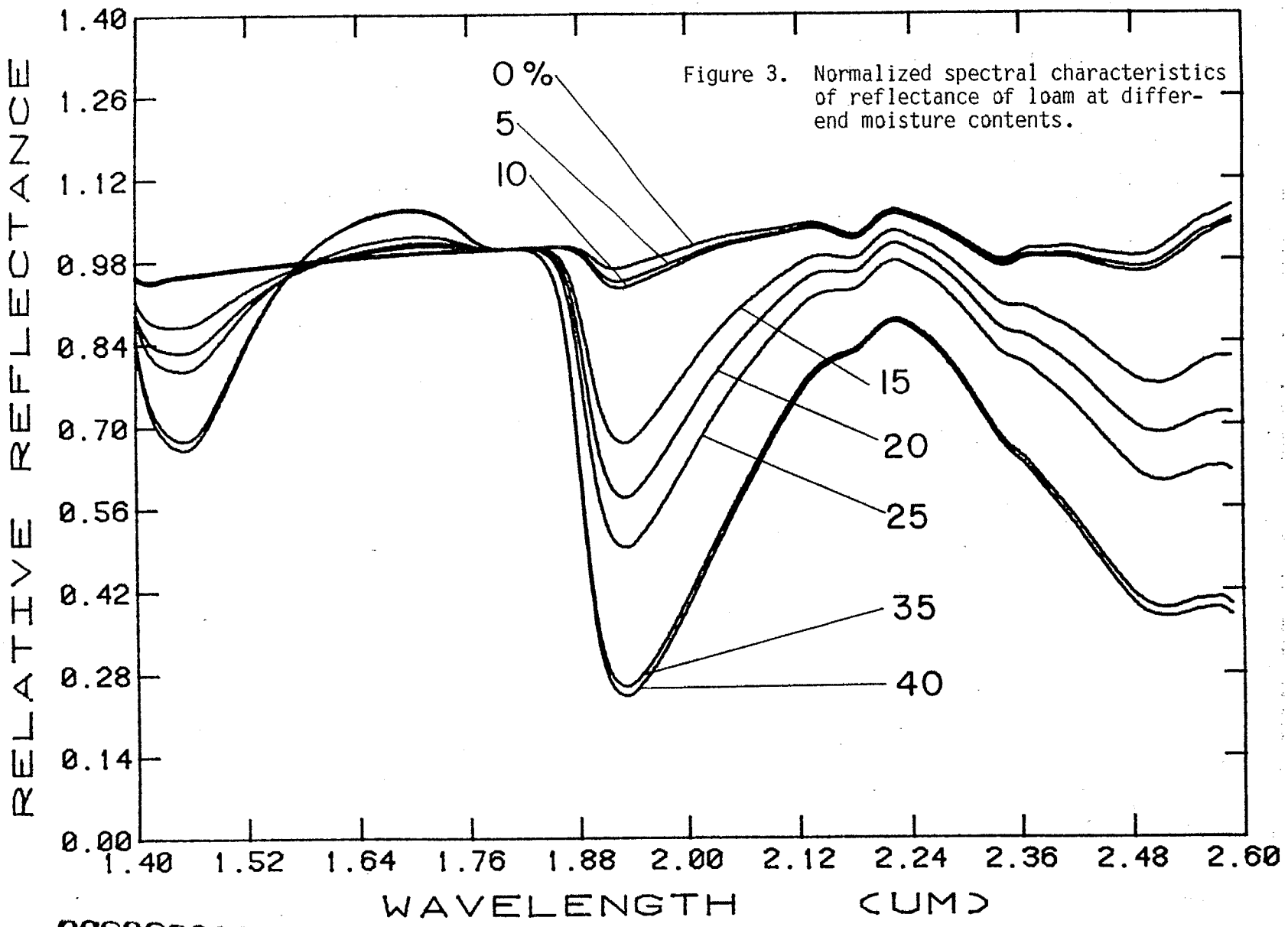

Figure 3. Normalized spectral characteristics of reflectance of loam at different moisture contents.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

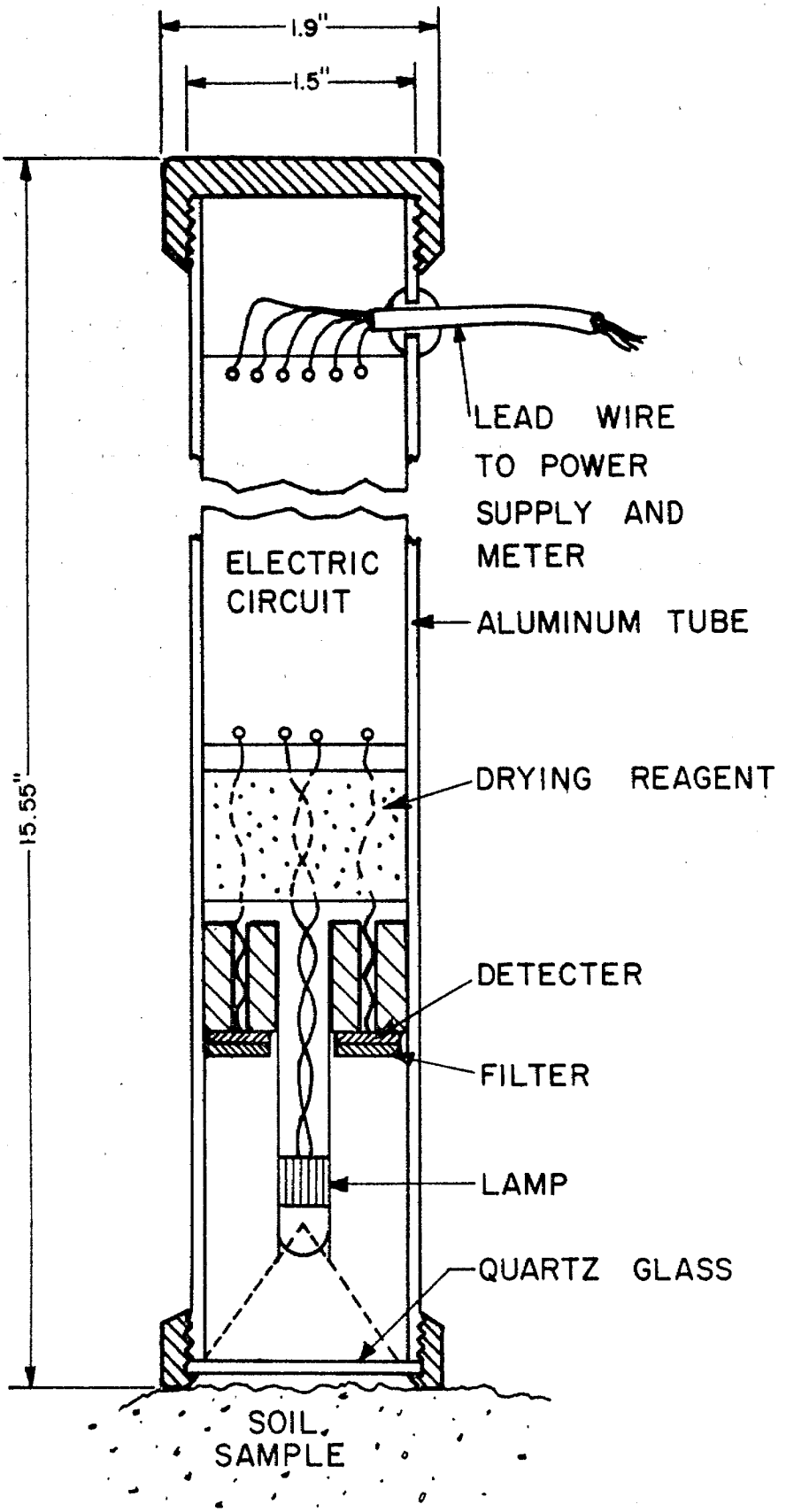

Figure 4. A cross-section of the moisture meter.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

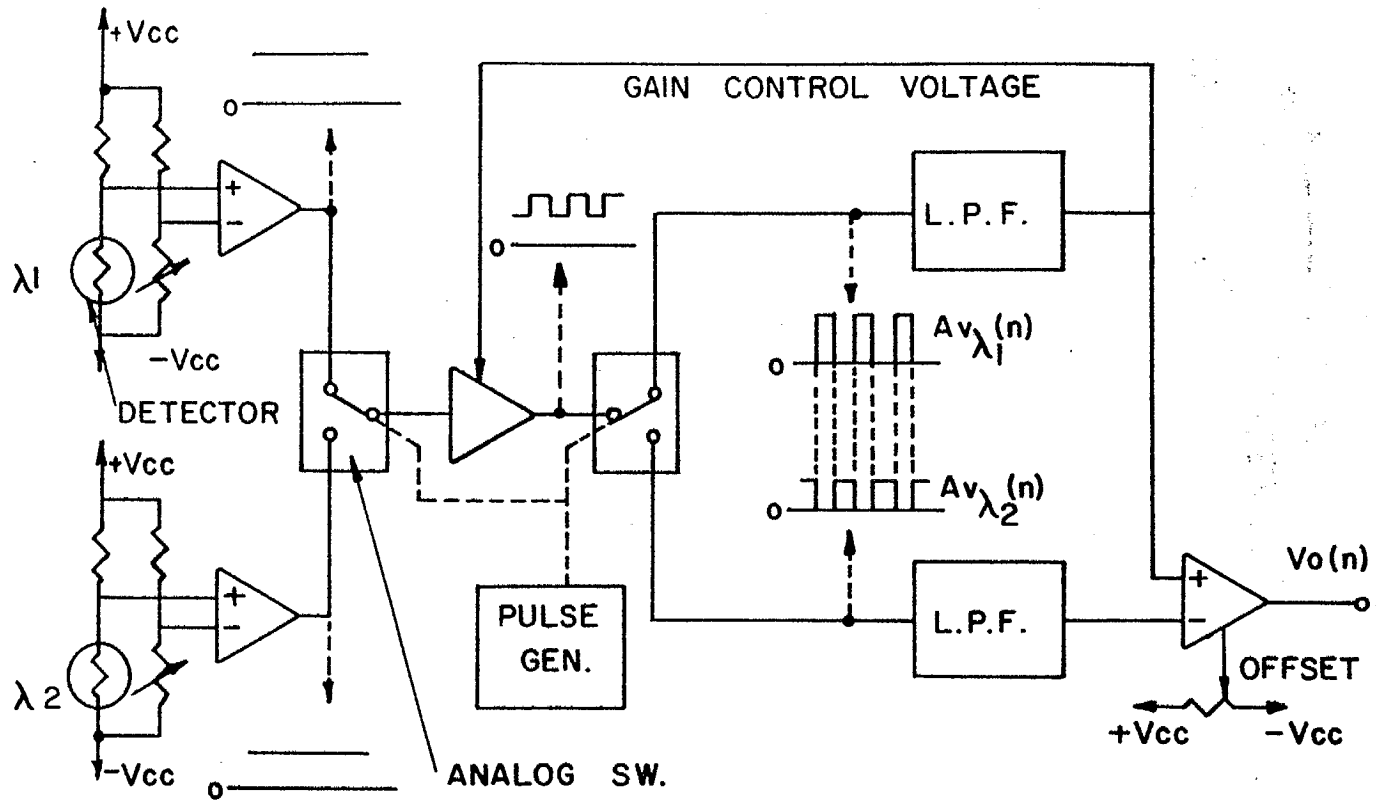

Figure 5. The block diagram of the electric circuit and the signals.

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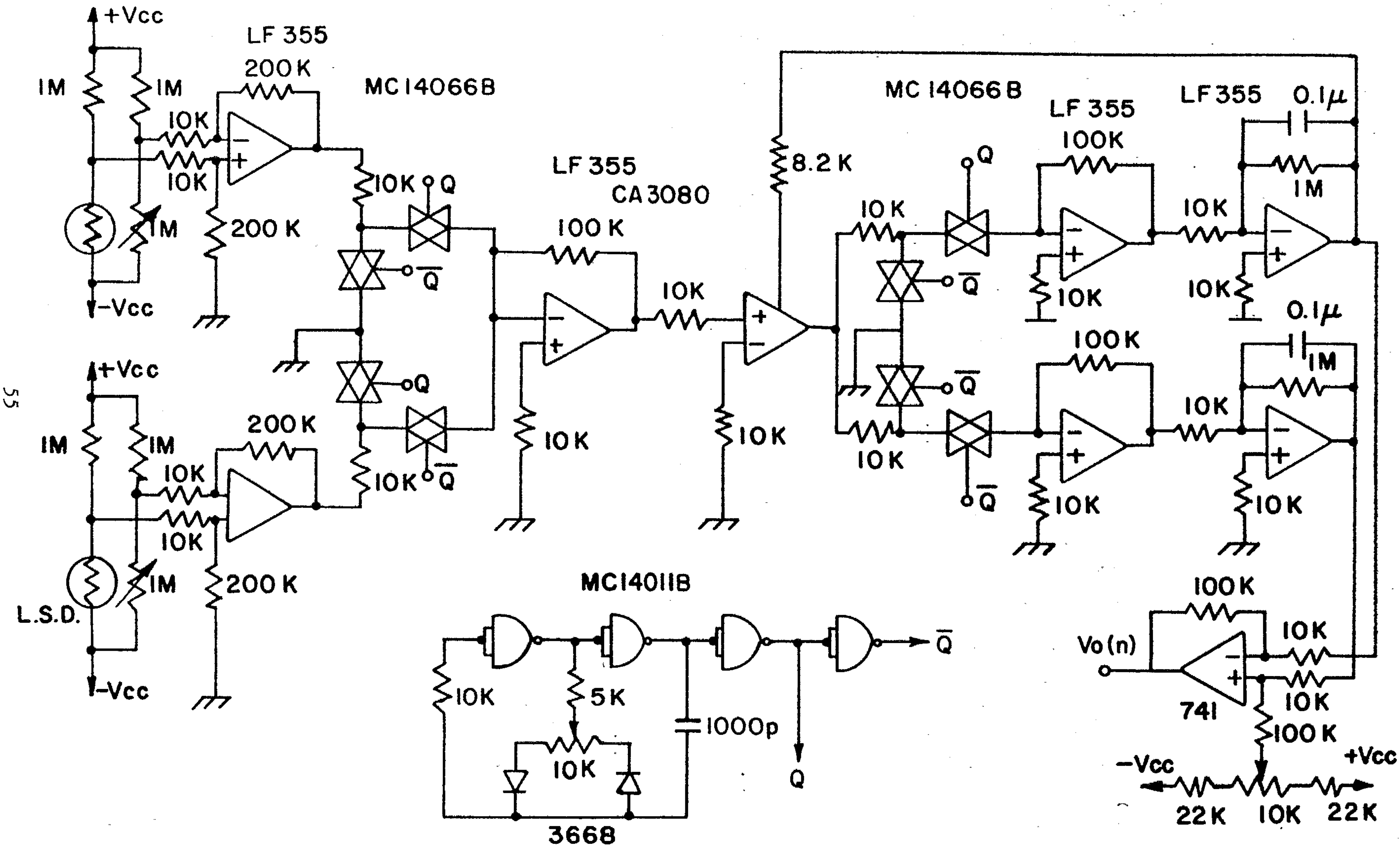
Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Figure 6. The electric circuit of the equipment.



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Source: https://www.industrydocuments.ucsf.edu/docs/ntyk0000

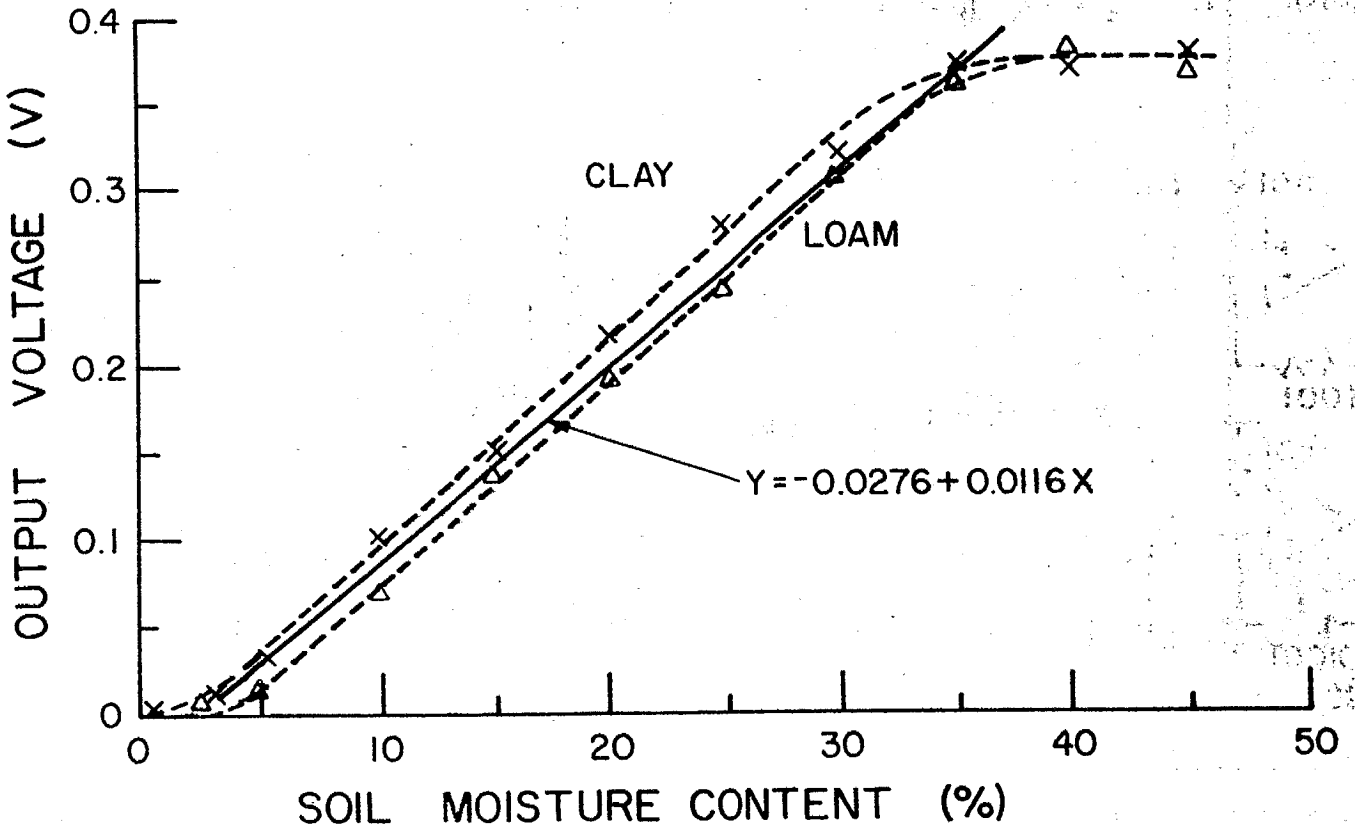

Figure 7. Relationship between the output voltage of the soil moisture meter and the soil moisture content.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

RELATIONSHIP BETWEEN NUCLEAR DNA CHANGES AND PLANT PRODUCTIVITY IN ANTHER-DERIVED DOUBLED HAPLOIDS OF NICOTIANA TABACUM

J.P. Miksche[1], S.S. Dhillon, and E.A. Wernsman[2]
Department of Botany[1] and Crop Science[2]

Summary of Research:

Nuclear DNA amounts and cultivar productivity of first and second cycle doubled haploids originating from two long-term inbred flue-cured tobacco (Nicotiana tabacum L.) cultivars, Coker 139 and NC 95, were compared. Doubled haploids were developed by anther culture, followed either by colchicine chromosome doubling treatment or leaf midvein culture. Arrays of second cycle doubled haploid lines were developed by anther culture of first cycle doubled haploid lines. The nuclear DNA amounts were determined by microspectrophotometry in genotypes (seven for each cultivar, Coker 139 and NC 95), which showed an average of 17% reduction in leaf yield per cycle of androgenesis. The DNA values varied from 7.45 pg to 10.32 pg per nucleus and the dihaploids in general possessed higher DNA amounts and lower plant productivity in comparison with source cultivars. Regression studies of DNA per nucleus versus leaf yield, plant height and sugar, showed a significant negative correlation with r values of -.601, -.738 and -.669, respectively. The negative correlation between increased amount of DNA and reduced growth and leaf yield is difficult to explain. However, higher amounts of heterochromatin and highly repeated sequences associated with increased DNA amount as noted in our previous studies (Dhillon et al. 1983. Can. J. Genet. Cytol. 25:169) and concurrently by French workers (De Paepe et al. 1982. Plt. Sci. Letters 28:11) may suggest the masking or interfering of normal gene expression which results in lower yields and reduced growth.

Publications:

Dhillon, S.S., E.A. Wernsman and J.P. Miksche. 1983. Evaluation of nuclear DNA content and heterochromatin changes in anther-derived dihaploids of tobacco (Nicotiana tabacum) cv. Coker 139. Can. J. Genet. Cytol. 25:169-173.

Paper to be Presented at a Professional Meeting:

Dhillon, S.S., E.A. Wernsman, J.P. Miksche, and L. Henry. 1984. Relationship between nuclear DNA changes and plant productivity in anther-derived doubled haploids of Nicotiana tabacum. Annual Meeting, American Society of Plant Physiologists, Davis, California.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

NCO 03435 Tobacco Growth Regulators and Plant Uniformity

in a Transplanted Crop

Project Leader: H. Seltmann (USDA, ARS)

I. Summary of Research:

A. Regional tobacco growth regulator tests.

B. Effect of simulated rain on MH-treated tobacco.

C. Comparison of directed vs. overall applications for sucker control.

D. Effect of ethephon on transplanted tobacco.

A. Regional Tobacco Growth Regulator Test

The regional test (Table 1) during 1983 compared a straight chained fatty alcohol (Off-Shoot T = OST) as a dual application using a 4% concentration (OST/OST: 4%/4%) and a 5% concentration with an experimental material containing branched chain alcohols (BBC-1). In addition, a labelled product containing branched chain alcohols (Royaltac 85 = RT 85) was used as a dual application at 4%/4%, 4%/5%, and 5%/5%. The higher concentrations of the alcohols resulted in better control. There does not appear to be much difference among the various alcohols with respect to control. The better control tended to result in higher yields, an expected result.

A soluble granular formulation of potassium maleic hydrazide (Royal MH-30 SG = KMH-SG) was compared to the liquid formulation (KMH) following an application of fatty alcohol (FA). Sucker control was essentially the same with both of the MH preparations.

A dual application of chloropropham (Bud Nip = BN) at a reduced rate was used following an initial application of FA with very good results. No phytotoxicity was apparent on the upper leaves. Plants were topped down to a good sized leaf before application of the BN and the use of the FA inserted a delay into the procedure, thus permitting the upper leaves to mature some before being exposed to the BN.

Finally, KMH was used in a dual application at a reduced rate of 0.5x following an initial application of FA. Sucker control was excellent.

All applications were made with a 3-nozzle, hand-held boom that simulated commercial equipment. No nozzle or pressure changes were made from the FA applications to the MH applications. The applications were made on weekly intervals.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Worsham, A.D. The potential for conservation tillage. Cons. Tillage Symp., Auburn, AL, October, 1983.

Worsham, A.D. The potential for no-till tobacco. Soil Cons. Serv. Meeting, Bright Leaf Erosion Project, Snow Creek, VA, March, 1983.

Doyle, Sandra and A.D. Worsham. The potential for soil savings in flue-cured tobacco through conservation tillage. Soil Cons. Serv. of Amer. Ann. Meeting, Hartford, CT, August, 1983.

VIII. Graduate Student Theses Completed During the Reporting Period:

Shilling, D.G. "The Suppression of Certain Weed Species by Rye (Secale cereale L.) Mulch and Isolation, Characterization, and Identification of Water-soluble phytotoxins from Rye."

IX. Acknowledgements:

Appreciation is expressed to the North Carolina Tobacco Foundation, Inc., for support of the Graduate Assistantship for work in no-till tobacco and allelopathy.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

B. Effect of simulated rain on MH-treated tobacco.

Following an unexpected shower after the application of MH, a grower will usually reapply the same amount of MH, if the time between the initial application and the shower is less than 6 hours. In 1982 it was determined that 0.5x rate of MH was sufficient to reestablish control, if rain occurred within 12 hours after the initial application. Also, a slight shower of 0.1 inch will not reduce sucker control enough to warrant a reapplication of MH although small effects in reduction of sucker control were noted.

Using the same field lay-out as in 1982, good sucker control practices were initiated the week prior to the beginning of the experiment with the application of fatty alcohol using a high-clearance sprayer. Topped plants were applied with the labelled rate of MH (12 pints to KMH) and irrigation sprinklers were set up. Plots consisted of 10, 22-plant rows between the irrigation pipes. Data were obtained from the six center-most rows that received subtreatments. Irrigation water of approximately 2.0 cm was applied at 3, 6, 9, and 12 hours after the application of MH. (A no-rain check was irrigated the day before to keep the amount of water applied to all plots the same.) The six plot rows containing the subtreatments were treated as follows:

1. No further treatment;

2. 0.25x MH as an overall application (with hand-held equipment);

3. 0.5x MH as an overall application;

4. 0.25x MH as a directed spray;

5. 0.5x MH as a directed spray;

6. Covered plants with polyethylene so that only 0.2 cm of rainfall wetted the plants. No reapplication of MH was made.

The data in Table 2 indicate that (1) at least 12 hours are necessary between MH application and a good rain to obtain good sucker control. This result confirms that obtained in 1982. (2) A reapplication will require at least 0.5x rate of MH. A 0.25x rate will give some improvement of sucker control, but it will not give the high degree of control that is so desirable. (3) A directed spray of 0.5x rate of MH will result in as good control as the overall spray. The latter would probably leave a lower residue according to our earlier studies that compared the two methods of application. (4) A slight shower (0.2 cm), if it comes early, may require some additional MH. This result is somewhat different from the one obtained in 1982 where it seemed unnecessary to make a reapplication of MH.

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Table 2. Sucker control with reduced amounts of reapplied MH following a 2.0 cm rainfall.

Time of rainfall	Amount of MH reapplied					Rainfall 0.2 cm
	None reapplied	Overall		Directed		
		0.25x	0.5x	0.25x	0.5x	
--	99	99	99	99	99	99
3 hr	56	78	92	79	90	86
6	62	80	94	87	96	88
9	70	85	94	79	94	94
12	91	95	97	97	98	95

Table 3. Comparison of directed (x) versus overall (o) applications of combinations of growth-regulating agents.

	Sucker Control %		Yield lb/a		Quality Index		Total Alkaloids %		Reducing Sugar %	
	x	o	x	o	x	o	x	o	x	o
1	-	-	2048	2082	78	76	2.61	2.42	15.28	15.88
2	99	99	3276	3198	50	53	3.28	3.64	15.98	14.40
3	98	99	3139	3043	60	48	3.26	3.57	16.50	14.22
4	93	98	3308	3142	55	51	3.24	3.16	16.35	17.82
5	84	91	3229	3033	56	50	3.44	3.44	15.15	14.50
6	95	92	3048	3166	48	51	3.23	3.25	14.02	13.68
7	96	94	2980	2768	50	55	3.18	3.13	15.72	15.55
8	79	91	3001	2894	48	52	3.11	3.14	16.45	15.62
9	65	81	2137	1984	76	80	1.91	2.12	17.08	16.85

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

C. Comparison of directed vs. overall applications for sucker control.

We continued the comparison between the directed spray versus the overall spray application using some new chemical combinations in addition to those that have been successful. The treatments were as follows:

1) TNS = topped and not suckered;

2) FA/FA/MH; FA = fatty alcohol

3) FA/FA/MH-SG; MH-SG = soluble granular KMH

4) FA/(FA + 0.5x MH)/
(FA + 0.5x MH); ( ) = tank-mix

5) FA/(FA + 0.5x MH-SG)/(FA + 0.5x MH-SG);

6) FA/FA/DS-36991; DS-36991 = experimental chemical

7) (FA + ethephon)/FA/0.75x MH; ethephon = 50 mg/plant

8) FA/(0.5x MH + 0.5x ethephon)/(0.5x MH + 0.5x ethephon);

9) (0.5x MH + ethephon) applied to not topped plants in elongated bud stage.

The data (Table 3) are only from the Clayton location. The Whiteville location received an evening shower following the third applications. This may have contributed to the relatively poor sucker control obtained.

Sucker control data indicate little difference between the overall and directed spray methods for treatments #2 and #3. However, the overall spray method is favored in #4 and #5. The directed method was favored in #6, a contact-systemic type agent. For a systemic agent the directed spray cannot be set too narrow so that enough leaf surface is wetted to allow for enough absorption to effect a high degree of control.

The use of ethephon during the bud stage of plant development does not tend to yellow the tobacco as it would when used on a plant where senescence has started, but rather it tends to effect the development of the floral buds. Many buds will absciss from both the ethephon and the MH. After the effect of the ethephon-MH applications were observed, the plants were topped. These tops were not developed in the usual manner, but rather were devoid of seed capsules. The ethephon-MH tank-mix in treatment #9 was not topped. The effect is obvious in the low yield obtained and in the low value for percent total alkaloids. Of the ethephon-containing treatments sucker control was good only with treatment #7.

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Because of excessive spring rains, an attempt was made to replace fertilizer that presumably had been leached. The estimates were excessive and the tobacco was over fertilized as witnessed by the high yields. Of interest, however, are the quality index values for treatments #1 and #9. These treatments had exceptional good tobacco although the yields were low. The excessive sucker growth provided the metabolic sinks for the excesses of nitrogen. This would suggest that some sucker growth may attribute to a higher quality.

MH residue analyses by the NCSU Pesticide Residue Laboratory indicated that lower residue values are obtained with the directed spray, especially when the chemical combinations as in treatment #4 are used.

MH residue (ppm) from Whiteville, 1982.

	Priming			
	A	B	C	D
Treatment #2- FA/FA/MH				
Overall	37	26	30	46
Directed	32	38	30	41
Treatment #4 - FA/(FA + 0.5x)/(FA + 0.5x MH)				
Overall	65	30	25	52
Directed	42	20	17	24

These values are low in reference to the 80 ppm level we have heard so much about. The values are low for two reasons: (1) there was at least a one-week delay following MH applications before a harvest occurred; (2) there was a period of afternoon and evening showers that came 24 hours after the MH applications were completed. These showers obviously removed an excess chemical that was not absorbed by the plant. These external residues are not involved with sucker inhibition, but they can increase chemical residue values.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

D. Effect of ethephon on transplanted tobacco.

For the second season ethephon (1000, 1500, and 2000 ppm) has been applied as a foliar spray to tobacco one, two, and three weeks after transplanting. There was an obvious retardation of growth when compared to the untreated control. As the plants grew larger, the differences in size due to retardation of growth became less obvious. Plants tended to be of the same height when they came into bud. The untreated control plots flowered first and had plants in flower over a longer period of time than the ethephon treated plots. The ethephon treated plots were thus more uniform with respect to flowering.

Plants treated with 1500 ppm one and two weeks after transplanting yielded significantly more cured tobacco (150 lb/a) than the untreated control. Cured leaf from the untreated control plots was higher in percent total alkaloids than the leaf from most of the ethephon-treated plots. The earlier flowering untreated control was topped earlier than the ethephon treated, allowing more time to develop nicotine. All treatments were harvested at the same rate once harvesting began.

II. Publications, Reports, Abstracts

Clapp, M. K. K., and H. Seltmann. 1983. Anatomy of axillary meristems from tobacco plants treated with maleic hydrazide. Bot. Gaz. 144:86-91.

Black, R. R., W. K. Collins, R. C. Long, and H. Seltmann. 1983. Responsiveness of flue-cured tobacco varieties to ethephon. Tob. Sci. 27:30-34.

Weeks, W. W., and H. Seltmann. 1983. Volatile and non-volatile compounds after different degrees of sucker control in flue-cured tobacco. Abstract 37th Tobacco Chemists' Research Conference, October 10-13. Washington, D.C.

Seltmann, H., and J. A. Priest. 1984. 1982 Regional Tobacco Growth Regulator Tests: Flue-cured. Progress Report USDA, ARS, Southern Region, Mid-Atlantic Area Research Report No. 1. pp. 52.

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Table 18. RAINFALL

Reidsville, 1983

Date	May	June	July	August	September
1	0	0	.01	0	0
2	0	.01	T	.16	0
3	0	0	0	0	T
4	.58	.12	0	0	0
5	0	.17	.10	0	0
6	0	0	0	0	0
7	0	.13	0	.43	0
8	0	.28	0	0	0
9	T	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	.41	0
13	0	0	0	0	0
14	.02	0	0	0	.47
15	.09	.49	0	0	.14
16	0	0	0	0	0
17	.49	0	0	0	0
18	0	0	0	0	0
19	0	.12	0	0	0
20	.55	0	0	0	0
21	.65	.13	0	0	.01
22	.08	0	.10	0	.40
23	0	0	.05	0	0
24	0	0	.10	.69	0
25	0	0	T	0	0
26	0	0	.04	0	0
27	.08	0	0	0	0
28	0	0	0	0	0
29	0	.12	0	0	0
30	.66	.34	0	0	.23
31	0	0	0	0	0
Total	3.20	1.91	.40	1.69	1.25

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VIII. Graduate Student Thesis Completed During Report Period:

None

IX. Acknowledgments:

A portion of this work has been funded by the N. C. Tobacco Foundation which has provided the graduate student stipend.

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NC 05524 TOBACCO TISSUE CULTURE AND CYTOGENETICS

S. M. Reed, Project Leader

I. Summary of Research:

A. Interspecific gene transfer via pollen irradiation.

The objective of this study is to determine if small amounts of genetic material can be transferred from a wild Nicotiana species to N. tabacum via irradiated pollen. The procedure that is being used involves following the transfer of two genes from N. glutinosa to a genetic marker stock of N. tabacum.

Pollen of N. glutinosa has been collected in gelatin capsules and exposed to gamma-irradiation dosages of 0, 10, 25, 50 and 100 krads. This pollen has been applied to a SC58 line carrying the yellow-green (yg) marker gene. Progeny of these crosses have been planted and screened for the presence of the "green-factor" from N. glutinosa, which returns full chlorophyll production to the plants. The transfer of TMV resistance from N. glutinosa is also being used to screen progeny; however, this work is still incomplete. Chromosome counts are being obtained on selected plants. In addition, the morphology of the plants is being used as an indicator of amount of alien genetic material transferred.

The results obtained to date indicate that the 10 and 25 krads of irradiation eliminate only a small part of the N. glutinosa genome. The amount of chromosome loss is much greater with 25 krads than with the lower dosage. Over 20% of the progeny resulting from the 25 krad irradiation had lost the gene for chlorophyll production from N. glutinosa, while only 3% of the 10 krad progeny showed the yg phenotype. Both groups of plants had a variable hybrid morphology; however, the range of plant types was greater with 25 krads than with 10 krads. All but one of the 50 krad progeny and all of the 100 krad progeny appeared to be maternal haploids. This indicates that all of the genetic material of N. glutinosa was destroyed at these irradiation levels. One of the plants resulting from the 50 krad irradiation was slightly different in appearance from the other plants in this group. Cytological analysis showed the presence of 25 chromosomes. Thus, it appears that this irradiation level defines the upper limit of dosages capable of allowing transfer of genetic material following irradiation.

Additional crosses are being made to determine if any irradiation level consistently produces progeny with only small amounts of genetic information from the pollen parent. Irradiation dosages ranging from 25-50 krads are being tested with large numbers of crosses. Screening for TMV resistance and chlorophyll production in the progeny will continue. If this procedure proves to be effective, it will be applied to the transfer of other genes of commercial importance.

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B. Cross-restoration of N. tabacum CMS lines.

The purpose of this project is to study the nature of cross-restoration among several N. tabacum cytoplasmic male sterile (CMS) and restorer lines. Restorer lines having N. repanda (rep), N. undulata (und), N. bigelovii (big) and N. suaveolens (sua) cytoplasms were used to pollinate sterile and restorer lines having rep und, big, sua, and N. debneyi (deb) cytoplasms. Flower morphology and pollen fertility were studied in the progeny of these crosses.

The results that have been obtained so far are presented in Table 1. The rep restorer chromosome had the most effect on the sua sterile line. The flowers of this line completely lack anthers. The addition of the rep restorer chromosome to this line produced plants with normal anthers having a high degree of pollen fertility. The effect of the rep restorer chromosome on other lines was less drastic. The flower of the deb sterile has a corolla with multiple splits extending the entire length of the corolla. The addition of the rep restorer chromosome to this line decreased the number of splits in the corolla and reduced the length of the splits. When the rep restorer chromosome was added to the und sterile line, no effect was noted. However, when it was added to the restored und line, an increase in pollen fertility was noted. Apparently, the rep restorer chromosome was unable to restore pollen fertility to the und sterile line until the anthers were first restored by the und restorer chromosome. The rep restorer had no effect on the big sterile, but a decrease in fertility was noted when the rep restorer chromosome was added to the big restored line.

The analysis of the lines incorporating the big restorer chromosome has not yet been completed. Of those crosses that have been studied, only the deb sterile line was affected by the addition of the big restorer chromosome. Complete restoration of flower morphology and pollen fertility were observed. The restored deb has normal flower morphology, but still lacks pollen fertility. Thus the rep restorer chromosome has a greater effect on the deb sterile than does the deb restorer chromosome.

The analysis of the remaining cytoplasm-restorer combinations is currently underway.

C. In vitro screening of blue mold resistance.

The objectives of this study are to determine if differences between blue mold (Peronospora tabacina) resistant and susceptible lines exist in vitro and, if so, if they can be used for screening for resistance. Callus cultures of two resistant and two susceptible N. tabacum lines were inoculated with blue mold conidia. The cultures were observed under a dissecting microscope at regular intervals to assess amount of mycelial growth. A few initial attempts to induce sporulation were also made.

No differences have been noted between the callus derived from the resistant and susceptible lines. Callus of both lines has been

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colonized by mycelia. Because of the erratic nature of the colonization, it has not yet been possible to determine if quantitative differences in mycelial growth exist for the resistant and susceptible lines. It has not yet been possible to induce sporulation in either type of culture.

IV. Publications:

Sharp, W. R., S. M. Reed and D. A. Evans. 1983. Production and application of haploid plants. In Crop Breeding - A Contemporary Basis (ed. P. B. Vose and S. G. Blixt). Pergamon Press, Oxford. pp. 347-381.

VII. Papers Presented at Professional Meetings:

Reed, S. M. and E. A. Wernsman. The doubled haploid experience in Nicotiana. 1983 American Society of Agronomy Meeting.

IX. Acknowledgements:

The support of the R. J. Reynolds Tobacco Company through the R. J. Reynolds Undergraduate Apprenticeship Program is gratefully acknowledged. Much of the work reported in section I. C. was carried out by Mr. R. J. Sloan while he was serving as an R. J. Reynolds apprentice.

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Table 1. Cross restoration among N. tabacum CMS lines

Cross	Effect of restorer chromosome
und sterile x rep restored	no effect
und restored x rep restored	improved pollen fertility
big sterile x rep restored	no effect
big restored x rep restored	possibly reduced fertility
sua sterile x rep restored	restored anthers and pollen fertility
sua restored x rep restored	no effect
deb sterile x rep restored	partially restored corolla morphology
rep sterile x big restored	no effect
deb sterile x big restored	restored flower morphology + pollen fertility
sua sterile x big restored	no effect
sua restored x big restored	no effect

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TOBACCO BREEDING AND GENETIC RESEARCH

James F. Chaplin

I. Summary of Research:

Two flue-cured tobacco breeding lines with different alkaloid levels were developed and are being released:

1. LMAFC-34 (Low Medium Alkaloid Flue-Cured-34) is being released. The alkaloid content of the cured leaf is approximately 1.00% on a dry weight basis and consists primarily of nicotine since the line does not convert nicotine to nornicotine. Nicotine is a very important constituent of tobacco. The nicotine level in commercial cultivars of flue-cured tobacco is constant. It is very important that this level be maintained, however, there is a need for tobaccos with different levels of nicotine for research and other purposes. In 1974 the USDA-ARS and NC Agricultural Research Service released a low alkaloid breeding line (LAFC-53) which produces leaf with approximately 0.20% total alkaloids. This line has been used extensively in research studies; however, the line does not cure and ripen well. The new line, LMAFC-34 has more acceptable ripening, curing and yielding qualities. LMAFC-34 was developed from an anther-culture derived haploid that was doubled with colchicine to produce a pure line. The anther source of the haploid was developed by backcrossing a low-alkaloid line (0.20% total alkaloids) to NC 95 and selection of low alkaloid plants in the F_2 generation. After the fifth backcross haploids were produced and doubled that had different levels of total alkaloids. LMAFC-34 was selected from among these lines. The new breeding line is genetically stable for total alkaloids and growth characteristics. It may be used as breeding material to develop varieties with varying levels of nicotine and to be used in experimental studies where low nicotine levels are desirable.

LMAFC-34 was evaluated in replicated tests in two locations in North Carolina in 1978, 1979 and 1980. The new breeding line is similar to NC 95 in days to flower and number of leaves per plant. It equals NC 95 in yield and plants are about 12 cm shorter. The grade index is slightly above NC 95. The leaves ripen normally and cure to a good rich color. The smoke flavor also compares favorably with NC 95. LMAFC-34 is resistant to black shank and bacterial wilt. LMAFC-34 is being released to plant breeders, experiment stations, and other research organizations for research and breeding purposes.

2. MAFC-5 (Medium Alkaloid Flue-cured-5) is being released. The alkaloid content of the cured leaf is approximately 1.95% on a dry weight basis and consists primarily of nicotine since the line does not convert nicotine to nornicotine. Nicotine is a very important constituent of tobacco quality. The nicotine level in commercial cultivars of flue-cured tobacco is constant. However, with emphasis on lower tar and nicotine cigarettes, it is important for researchers to develop lines of tobacco with different levels of nicotine for experimental and breeding purposes. MAFC-5 was developed by backcrossing a low alkaloid line (0.20% total alkaloid) to NC 95 and selection of low

2005869 14

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alkaloid plants in F_2 generations. After the fifth backcross lines were self pollinated and selections made in the F_2 generation for varying levels of total alkaloids. MAFC-5 was selected for a medium alkaloid level and advanced to the F_7 generation. Cuban cigar lines are the source of the low alkaloid genes. The new breeding line is genetically stable for total alkaloid level and growth characteristics. The line possesses a level of total alkaloids not previously available in flue-cured tobacco and may be used to develop varieties with varying levels of nicotine.

MAFC-5 was evaluated in replicated tests at two locations in North Carolina in 1978, 1979 and 1980. The new breeding line is similar to NC 95 in days to flower, plant height and leaves per plant. The average yield is about 100 pounds lower and the quality index is not different from NC 95. The lines ripens and cures well. Also the smoke flavor compares favorable with NC 95. MAFC-5 is resistant to black shank and bacterial wilt. MAFC-5 is being released to plant breeders, experiment stations, and other research organizations for research and breeding purposes.

Test were conducted in 1981 and 1982 at Oxford to investigate the possibility of increasing selenium content of flue-cured tobacco. Selenium levels in tobacco were successfully increased by growing the plants in soil, with added sodium selenite, or by spraying growing plants with an aqueous solution of the chemical. Plants were treated at 4-32 mg selenium/plant levels. Plant treatments were five to ten times more effective in increasing selenium levels than soil treatments. Thus, soil treatments at 32 mg/plant increased selenium contents of tobacco leaf lamina to about 2 ppm, while a single plant treatment at the 0.5 mg level produced tobacco with about 0.7 ppm selenium. Pyrolyses of the cured tobacco showed that about 45% of the selenium could be transferred to tobacco smoke.

II. Graduate Students: One. (On one other committee.)

III. Post-Doctral Fellows: None.

IV. Publications:

1. Chaplin, James F. Developing tobacco varieties with high quality to meet farmer needs and manufacturers' demands. Tobacco issues for the 80's (Proceedings of an Educational Conference Sponsored by the Colleges of Agriculture in 5 flue-cured states Florida, Georgia, North Carolina, South Carolina and Virginia, March 8-9, 1983) pages 55-57. 1983.

2. Chaplin, J. F. and L. G. Burk. Agronomic, chemical and smoke charcteristics of flue-cured tobacco lines with different levels of total alkaloid. Agron. Jour. 76 (1984) 111-136.

3. Johnson, Albert W. and James F. Chaplin. Sources of tobacco budworm resistance in tobacco. Tob. Sci. 26 (1982) 157-158.

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4. Schepartz, A. I., R. L. Wilson and J. F. Chaplin. Variation in the mineral concentration of certain flue-cured tobaccos during curing. Tob. Sci. 27 (1983) 146-148.

5. Severson, R. F., G. R. Gwynn, J. F. Chaplin and J. D. Miles. Leaf trichome exudate associated with insect resistance in Nicotiana tabacum L. Tob. Sci. 27 (1983) 82-83.

V. Manuscripts Accepted for Publications:

1. Chortyk, O. T., J. F. Chaplin and W. S. Schlotzhauer. Growing selenium enriched tobacco.

2. Schepartz, A. I., R. L. Wilson and J. F. Chaplin. Relationship of free and total neutral lipids in a flue-cured tobacco during curing.

3. Severson, R. F., R. F. Arrendale, O. T. Chortyk, A. W. Johnson, D. M. Jackson, G. R. Gwynn and J. F. Chaplin. Quantitative methodology for the cuticular components of green tobacco.

4. Stavely, J. R., J. F. Chaplin and G. R. Gwynn. Brown spot resistant flue-cured tobacco germplasm.

5. Woodlief, W. G., J. J. Lam, J. F. Chaplin, W. S. Schlotzhauer and R. F. Severson. Homogenized leaf curing: deproteinization effects on leaf and smoke chemistry.

VI. Manuscripts in Review:

1. Jackson, D. M., R. F. Severson, A. W. Johnson, J. F. Chaplin and M. G. Stephenson. Ovipositional response of tobacco budworm moths (Lepidoptera:noctuidae) to cuticular chemical isolates from green tobacco leaves.

2. Williamson, R. E., L. A. Nelson, J. F. Chaplin and H. W. Spurr Jr. Calculations of tar in tobacco from other analytical data.

VII. Papers Presented at Professional Meetings:

1. Invited Papers.

Chaplin, James F. Developing tobacco varieties with high quality to meet farmer needs and manufacturers demands. Presented to Symposium "Tobacco Issues for the 80's".

2. Contributed Papers.

a. Chaplin, J. F., D. M. Jackson, R. F. Severson, M. G. Stephenson and G. A. Herzog. Effect of reciprocal grafts on insect resistance and chemical composition in tobacco. Presented to Sixth Biennial Plant Resestance to Insect Workshop.

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b. Jackson, D. M., R. F. Severson, A. W. Johnson, G. Herzog, M. G. Stephenson, J. F. Chaplin and G. R. Gwynn. Relationship between levels of cuticular diterpenes from several tobacco entries and observed tobacco budworm resistance. Presented to Sixth Biennial Plant Resistance to Insect Workshop.

c. Stephenson, M. G., J. F. Chaplin, D. M. Jackson, R. F. Severson, A. W. Johnson, G. A. Herzog, and G. R. Gwynn. Techniques for field screening tobacco entries for host plant resistance to insects. Presented to Sixth Biennial Plant Resistance to Insect Workshop.

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NC 05469 Tobacco Breeding for Germplasm and Varieties Resistant to Pests and Advantageous to Health

G. R. Gwynn, Project Leader

I. Summary of Research:

Breeding for insect resistance - Four groups of breeding material and genetic entries were tested at Tifton, Georgia under natural infestation conditions in 1983. Three families were also tested at Oxford under artificially infested conditions where larvae were placed on the bud leaves and protected from predators with a perforated plastic bag. The target insect was the tobacco budworm although hornworm and aphid data was collected at Tifton. Washes of the bud-leaves with methylene chloride and subsequent analysis by gas chromatography provided quantitative measures of certain chemicals. Much of the data analyses and some of the chemical analyses remain to be done. Preliminary examination of the data indicates there are differences between the parents and among different F2 progenies. Correlation of chemical levels with damage score and percent infestation in the TI 165 x NC 2326 family was negative in all cases and significant but not high at Tifton. However, chemical levels were more highly correlated with budworm survival and growth rate under infested conditions at Oxford. Table 1 shows insect damage and infestation at Tifton and number of surviving larvae and growth at Oxford for certain entries.

Table 1. Damage score, percent infested, number of surviving larvae and average larval weight on NC 2326, TI 165, and selected F2 progeny.

Entries	Tifton		Oxford			
	Damage Score	Infested %	Surv. Larvae No		Larval Wt mg	
			Test 1	Test 2	Test 1	Test 2
TI 165	.09	8.5	.6	.2	15.2	1.4
NC 2326	1.71	75.0	3.2	2.6	103.7	95.9
G3- 9	1.15	56.5	.6	2.2	5.9	25.3
G3- 13	.13	12.5	1.4	1.2	19.4	9.7
G3- 17	.11	11.0	1.0	1.2	9.5	6.2
G3- 19	.08	8.0	.6	2.2	2.7	37.9
G3- 23	.96	75.0	2.0	1.0	32.5	26.8
G3- 25	.14	13.5	1.4	2.6	25.6	19.2
G3- 77	.84	50.0	2.8	4.0	71.5	58.7
G3- 89	.51	41.5	3.0	2.8	32.5	57.2
G3-100	.13	12.5	1.4	2.6	43.1	14.7
G3-109	.08	8.0	1.8	2.4	23.9	50.3
G3-113	.50	42.0	2.0	2.4	21.6	43.9
G3-121	.75	75.0	1.0	1.8	15.6	56.7
G3-124	.18	18.0	1.8	1.6	20.5	40.9

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Bacterial wilt resistance - Several genetic populations were grown in 1983 at two naturally infested sites in Lenior County, North Carolina. Percent-diseased was very high at the Seymour farm and moderately high at the Casey farm. At both locations 79A and 79X entries seemed to have more resistance than TI 448A but certain flue-cured varieties which derive their resistance from TI 448A were also high in resistance. As in past years (Ref. 1982 report) several breeding systems imposed on a four-parent hybrid were compared and differences found. Some of the lines originally selected according to a pedigree system and later bulked as mass selected material appeared to have good resistance.

Inheritance of Sucrose Esters - Sucrose esters are one of the classes of chemicals found in methylene chloride washes of leaf surfaces of young tobacco leaves. TI 165 regularly produces these chemicals while NC 2326 does not. The mode of inheritance of this phenomenon was investigated by washing leaves of parents, F1, F2, backcrosses to both parents, and F2 progeny. Results of these washes are shown in Table 2. The results indicate a single factor dominant is responsible for the presence of sucrose esters in crosses of TI 165 x NC 2326. Other T.I.s which also produce segregating progenies are TI 163, TI 1068, TI 1396, TI 1024 and TI 1298.

Table 2. Sucrose ester levels in leaf washes from bud leaves of TI 165, NC 2326, and various genetic populations and chi-square results.

Entry	Sucrose Esters gm/cm^2
TI 165	11.58
NC 2326	ND[1/]
F1 TI 165 x NC 2326	11.00

	With Sucrose Esters		Without Sucrose Esters			
	Observed	Expected	Observed	Expected	χ^2	p
F2	234	222	62	74	2.59	.10-.25
BC1(F1 x TI 165)	70 plants all had sucrose esters					
BC2(F1 x NC 2326)	48	43	38	43	1.16	.25-.50
F2 progeny	38 F2 progeny segregated 42 expected to segregate				.48	.75-.90

1/ ND none determined

Repanda as a source of resistance - Twenty-six breeding lines that involved flue-cured varieties backcrossed to hybrid material between flue-cured varieties and Nicotiana repanda were grown at Blackstone, Virginia in cooperation with Dr. J. Reilly on a cyst nematode nursery. Based on egg count, number of male nematodes and height of plants, some

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of this material appeared to be resistant. Selections within lines were made and backcrossing carried out.

Two groups of breeding material consisting of breeding lines involving repanda germplasm with various amounts of flue-cured backcrossing were tested at black shank nurseries at Kinston and Oxford and at a non-diseased location at Oxford. Most plants were checked for mosaic resistance. Survivors were selfed and in some cases backcrossed. Selfed seed of mosaic resistant plants were seeded in the greenhouse and checked again for mosaic resistance. Some of the progenies should have been stable for mosaic resistance but none were found indicating that perhaps the repanda chromosome material has not been stabilized. The frequency of resistant segregates has increased however.

Release of NC 85. NC 85 was developed and tested as NC48USDA and the name changed to NC 85 to avoid confusion with Coker 48. It was developed through various stages of inbreeding and pedigree testing from a cross of Coker 319 by Coker 298. It will be released to seed producers in 1984 as a F12. NC 85 is a good quality variety as shown by its high price-per-pound and grade index, high percent usability, and high percentages of cured lef in the more desirable categories of color, body, and texture. It matures and ripens well with a low number of ground suckers, normal height, and normal number of leaves. NC 85 is equal to NC 95 in yield. It has a good level of nicotine and sugar and is very close to the check varieties in level as well as ratios of these chemicals. It combines good quality and desirable chemical levels with a high degree of resistance to black shank and bacterial wilt. It was established as a variety in 1983 and will be produced in 1985.

Polyphenol and other constituents in selected tobaccos - Screening of certain tobaccos has been reported in the 1982 report. This effort was continued through 1983 by determining other constituents related to phenols and the derivatives therefrom. The Reynolds Tobacco Company assisted in this work through determinations of chlorogenic acid, rutin, and scopoletin on unburned leaf. Dr. W. S. Schlotzhauer pyurolyzed samples from the 1982 crop. Total phenol percentage by colormetric techniques (from Dr. R. E. Williamson), catechol and total phenol percentage through pyrolysis on certain entries are shown in table 3.

Table 3. Percent catechol and phenol from pyrolyzed tobacco and phenol on unpyrolyzed tobacco from certain varieties and T.I.s.

Entry	Catechol	Total Phenols (Pyrolyzed)	Total Phenol (colorometric)
		Percent	
TI 186	.049	.320	1.5
TI 504	.031	.207	2.5
TI 705	.066	.394	2.9
TI 875	.043	.313	2.1
TI 964-A	.038	.270	1.9
TI 1237	.031	.229	1.3

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Table 3. Continued:

Entry	Catechol	Total Phenols (Pyrolyzed) Percent	Total Phenol (colorometric
TI 1239	.042	.283	1.8
TI 1326	.048	.085	.3
TI 1421	.048	.297	1.6
V159	.048	.299	2.1
V160	.048	.316	2.0
V166	.051	.317	2.1
V175	.063	.368	2.7
V206	.040	.295	1.9
V216	.027	.225	1.1
V301	.047	.271	2.5
V409	.041	.278	1.9
V411	.040	.207	1.4
V414	.029	.209	1.0
V450	.072	.352	2.5
V451	.043	.284	1.7
V457	.069	.382	3.0
V458	.037	.286	2.3
SpG 28	.090	.455	3.6
NC 2326	.101	.479	4.3

II. Publications:

Rowe, D. E. and G. R. Gwynn 1983. Modeling of genetic effects with divergent selection for yield in tobacco dihaploids. Tobacco Science 27:95-98.

III. Manuscripts in Review:

Gwynn, G. R. and R. E. Williamson 1984. Recurrent selection for lower polyphenols within a cross of two flue-cured tobacco cultivars. Tobacco Science.

Gwynn, G. R. 1984. Registration of N. C. 50 Tobacco. Crop Science.

Gwynn, G. R. 1984. Breeding sources for lower sucker production in tobacco (Nicotiana tabacum). Tobacco Science.

IV. Papers Presented at Professional Meetings:

Gwynn, G. R., R.F. Severson and D. M.Jackson. Inheritance of leaf surface chemicals in tobacco and relationship to insect resistance. Poster paper at American Society of Agronomy, 1983, Washington, D. C.

Gwynn, G. R., R. F.Severson and D. M. Jackson. Inheritance of leaf surface chemicals in tobacco and relationship to insect resistance

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37th Tobacco Chemists' Research Conference, 1984, Washington, D. C.

Severson, R. F., D. M. Jackson, G. R. Gwynn, A. W. Johnson, M. G. Stephenson, and G. A. Herzog. Analysis of tobacco cuticular chemicals related to host plant resistance to insects. 6th Biennial Plant Resistance to Insects Workshop. 1984. Charleston, S. C.

Jackson, D. M., R. F. Severson, A. W. Johnson, G. Herzog, M. G. Stephenson, J. F. Chaplin, and G. R. Gwynn. Relationship between levels of cuticular diterpenes from several tobacco entries and observed tobacco budworm resistance. 6th Biennial Plant Resistance to Insects Workshop. 1984. Charleston, S. C.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

NC 05545 Genetic Investigation of Tobacco and the Nicotiana Species

V. A. Sisson

I. Summary of Research:

A. Genetic analysis of the factor for alkaloid production introgressed from N. rustica into N. tabacum.

The high nicotine producing species Nicotiana rustica var. brasilia was crossed with a low-nicotine producing flue-cured line of tobacco for the purpose of transferring the gene(s) for alkaloid production from this species into tobacco. After several generations of backcrossing and selfing, five stable lines with differing alkaloid levels were identified (Table 1.) From these lines four populations were constructed to study the inheritance of alkaloid production derived from N rustica.

Table 1. Total alkaloid content of parental lines derived from crossing N. rustica and N. tabacum.

Parental Line	Percent Total Alkaloids
39-4	5.41
20-4	4.56
9-6	3.51
11-5	2.52
7-3	1.52

Each of the four highest alkaloid producing lines was crossed to the line with the lowest percent total alkaloids. The F1's were selfed and also backcrossed with each of their respective parental lines. Test populations consisting of the P1, P2, F1, F2, B1, and B2 for each cross were grown in a completely randomized design in the field in 1983. Green leaf plugs were sampled from individual plants ten days after topping and percent total alkaloids determined using the Griffith method. Nonsegregating generations consisted of 36 plants, while segregating generations contained a total of 144 plants. The complete analysis of all populations is not yet available and only data for Population II, which had the parent with the highest percent total alkaloids in 1983, will be presented.

From the frequency distributions of percent total alkaloids for Population II (Table 2) it appears that both parental lines were effected by environmental factors. No distinct grouping could be identified in the segregating generations. However, using the mean plus on standard deviation of the frequency distribution of the low parent population (P2) as a class mark for the low alkaloid category, the F2 and B2 population data did not differ significantly from a 15:1 and 3:1 ratio, respectively. This would suggest that two major genes are involved in the production of

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Table 2. Frequency distribution of plants for percent total alkaloid in generations of Population II derived from crossing high alkaloid line with a low alkaloid line.

Classes	Generation					
	P1	P2	F1	F2	B1	B2
0.40-0.49		1				1
0.50-0.59		4				
0.60-0.69		2				2
0.70-0.79		6				1
0.80-0.89		10				2
0.90-0.99		3		1	1	6
1.00-1.09		2		3		4
1.10-1.19		2		1		10
1.20-1.29		1		1		8
1.30-1.39				2		7
1.40-1.49		1		2		11
1.50-1.59		2		7		14
1.60-1.69		2		3		16
1.70-1.79				4		4
1.80-1.89				9	1	8
1.90-1.99			1	2		10
2.00-2.09				5	1	5
2.10-2.19				4	1	7
2.20-2.29			1	8	2	9
2.30-2.39			1	4	3	5
2.40-2.49			2	11	2	1
2.50-2.59			1	5	1	1
2.60-2.69			3	5	3	5
2.70-2.79			3	2	4	1
2.80-2.89			3	4	6	
2.90-2.99			1	2	4	2
3.00-3.09			6	6	3	1
3.10-3.19			3	7	2	
3.20-3.29			1	2	6	2
3.30-3.39			1	6	9	
3.40-3.49			1	2	6	
3.50-3.59			2	2	7	
3.60-3.69	1			5	7	
3.70-3.79				6	7	
3.80-3.89	2		3	5	6	
3.90-3.99	2		2	1	8	
4.00-4.09	1			5	6	
4.10-4.19	2			3	7	
4.20-4.29	7			4	4	
4.30-4.39	1			1	6	
4.40-4.49	2			2	6	
4.50-4.59					4	
4.60-4.69	1				3	
4.70-4.79					3	
4.80-4.89	1				2	
4.90-4.99	2				3	
5.00-5.09	1			2	3	
5.10-5.19	4				1	
5.20-5.29	2					
5.30-5.39	1				1	
5.40-5.49	3				1	
5.50+	3				3	

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Table 3. Generation means of percent total alkaloids for test populations derived from crosses with low alkaloid line.

	Population			
Generation	I (39 x 7)	II (20 x 7)	III (9 x 7)	IV (11 x 7)
P1	4.28	4.68	2.67	2.07
P2	0.86	0.86	0.86	0.86
F1	2.73	3.05	1.59	1.76
F2	2.68	2.70	1.78	1.60
B1	2.97	3.64	2.00	1.65
B2	1.75	1.70	1.43	1.25

Table 4. R^2 values obtained from fitting genetic model to the generalized means.

	Genetic Model			
Population	m + d	m + d + h	m + d + i	m + d + h + i
11	.998961	.998964	.999044	.999516

alkaloids in this material.

Generation means of percent total alkaloids for the four test populations are given in Table 3. The four genetic models, 1) m+d; 2) m+d+h; 3) m+d+i; and 4) m+d+h+i where m is the mean, d is the additive effect, h is the dominance effect and i is the additive x additive effect, were tested based on the expectation of the generation means. The squared multiple correlation coeficients (R^2), which were used as a measure of the fit of the models, are presented for Population II in Table 4. Most of the genetic variation was accounted for by additive effects. The addition of dominance had very little effect on improving the model; whereas, the additive x additive component did increase the magnitude of the R^2 value.

Although it appears that the genetic system for alkaloid production introgressed from N. rustica into N. tabacum is very similar to the tobacco system, final conclusions must await the complete analysis of all test populations.

B. Enzyme genetics

1. Sensitivity to tentoxin, a fungal toxin, has been shown to be maternally inherited in the higher plant species examined, including those in the genus Nicotiana. Sensitivity is expressed as a partial to complete chlorosis in the seedling stage of development which ultimately results in death of the seedling after utilizing its cotyledonary reserves. The plastids of sensitive plant species which have been treated with tentoxin

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have been been found to lack polyphenol oxidase (PPO) activity, whereas, insensitive species retain PPO activity. The inheritance of tentoxin-induced loss of PPO activity was investigated to determine more precisely its association with tentoxin-induced "chlorosis."

A number of Nicotiana species and interspecific hybrids were examined for the loss of PPO activity after tentoxin treatment by using a highly sensitive cytochemical method. The results are summarized in Table 5. All of the species that became chlorotic after tentoxin treatment also lacked PPO staining activity after treatment. Insensitive species stained positively for PPO activity even in the presence of tentoxin. Hybrids containing the cytoplasm of a sensitive species, irrespective of the nuclear genome composition, were sensitive to tentoxin and lacked PPO activity after treatment. These data indicate that, like the chlorosis induced by tentoxin, the loss of PPO activity after tentoxin treatment, is cytoplasmically inherited. This observation along with other investigations suggests that polyphenol oxidase is the primary site of tentoxin induced chlorosis and PPO is responsible for the cytoplasmic inheritance of tentoxin-sensitivity, as measured by chlorosis.

Table 5. Reaction of Nicotiana species and hybrids to tentoxin: chlorosis and polyphenol oxidase activity.

Species and Hybrids	Chlorosis	PPO Activity
N. tabacum	--	+
N. rustica	--	+
N. sylvestris	--	+
N. debneyi	--	+
N. suaveolens	+	--
N. megalosiphon	+	--
N. cordifolia	+	--
N. kawakamii	+	--
4N(N. suaveolens x N. tabacum)	+	--
(N. sylvestris x N. kawakamii)	--	+
(N. kawakamii x N. sylvestris)	+	--

2. Tentoxin has been shown to prevent processing of polyphenol oxidase (PPO) into an active enzyme. Polyphenol oxidase which is coded by nuclear DNA and synthesized in the cytoplasm, is prevented from being incorporated into the chloroplasts of tentoxin-sensitive species. Ferredoxin-$NADP^+$ reductase (FNR) is another enzyme that is solely associated with chloroplasts, yet is synthesized in the cytosol. Various bits of biochemical data indicated that this enzyme is coded for in the nucleus; however, nuclear inheritance has not been demonstrated by classical genetic techniques. Several Nicotiana species and interspecific hybrids were used to demonstrate by classical means the mode of inheritance of FNR. It was also of interest to assess the effect of tentoxin upon the incorporation of FNR into the chloroplast.

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Polyacrylamide gel electrophoresis was used for the genetic analysis of the FNR enzyme. The species used in this study were: N. glutinosa, N. cordifolia, N. sylvestris, N. kawakamii, N. tabacum, N. suaveolens, and N. plumbaginifolia. Interspecific hybrids were: N. glutinosa x N. tabacum, N. tabacum x N. glutinosa, N. sylvestris x N. kawakamii, N. suaveolens x N. tabacum, 3N(N. cordifolia x N. tabacum) x N. tabacum and a hybrid with the complete substitution of the N. tabacum nuclear genome in N. plumbaginifolia cytoplasm.

All species studied showed the major activity in one or two isozymes. The isozyme banding patterns of all hybrid combinations were consistent with a nuclear mode of inheritance of FNR.

When the isozyme banding patterns of tentoxin treated seedling of sensitive and resistant species were compared with controls they were found to be both qualitatively and quantitatively similar. These results contrast with the effect of tentoxin on PPO in the same species. Therefore, the results indicate a selective inhibition of nuclear-coded protein transport by tentoxin and not a generalized disruption of chloroplast protein uptake in Nicotiana.

3. Anther-derived dihaploid lines of highly inbred tobacco cultivars have been found to be agronomically inferior to selfed progenies of the anther source. This reduction in performance has been associated with genetic variation among nuclear factors which develop from passage through the anther culture cycle, and has raised some doubt as to the practical application of this technique. The mechanisms responsible for the observed genetic changes are still a matter of speculation. Initial explanations suggested that either there is a certain amount of residual heterozygosity in the original cultivar which subsequently leads to inbreeding depression, or that there is some intrinsic mutagenic nature of the anther-culture process. More recently it has been proposed the DNA amplification may be responsible.

The use of plant proteins, or isozymes, as genetic markers offers a possible means of studying the genetic variation observed in dihaploid populations. Enzyme molecules are separated using electrophoretic techniques and specific enzyme activity can then be detected directly in the electrophoretic medium using histochemical staining methods. Isozyme electrophoresis can be used to detect mutation in a number of enzymes.

This study was undertaken to (1) assess the feasibility of isozyme electrophoresis in detecting genetic variability among haploid and dihaploid populations of tobacco and (2) to provide information on the nature and extent of the genetic variation associated with anther-derived doubled haploids.

Haploid and dihaploid populations were produced from the inbred flue-cured tobacco cultivar NC 2326 in the greenhouse. Leaf samples were collected at flowering and immediately frozen for subsequent isozyme analysis. Initially, the peroxidse isozyme system is being examined in this material. In the diploid cultivar there are five prominent anodic

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bands or zones of activity and one obscure band, with one or two faint cathodic bands. Preliminary results indicate that several dihaploids may be missing one or more of the major anodic bands or at least show quantitative differences in activity. This material is currently being analysed. Eventually, several isozyme systems will be used in evaluating these anther-derived materials and the results combined with field evaluation of agronomic characters.

C. Development of insect resistant germplasm

Five hundred doubled haploid lines were screened for resistance to the tobacco budworm at Tifton, GA and Whiteville, NC. These doubled haploids were derived from the third backcross of an adapted flue-cured variety to the breeding line I 35. Data was also recorded on general plant type, and resistance to tobacco hornworms and aphids. Ten lines were identified which were free of tobacco budworm damage. Each line was replicated twice and two damage readings were made over the season, one in late June at which time plants were cut off and once in August on the regrowth. Of the ten lines identified as resistant none had an acceptable plant type. Additional backcrossing and selection will be persued.

D. Development of tobacco germplasm with an alternate source of root-knot nematode resistance

All tobacco cultivars with resistance to the root-knot nematode, Meloidogyne incognita, have derived their resistance from a single source, T.I. 706. An association between resistnce to the root-knot nematode and a severe, necrotic reaction to a strain of potato virus Y (PVY) has been well established. This relationship is so close, in fact, that infection with PVY has been used as a means of screening for nematode resistance. The association between resistance to the nematode and the response to the virus has been shown to be due to the pleiotropic effects of a single gene.

When the Nicotiana species N. tomentosa acc. 58 was inoculated with both pathogens it was highly resistant to the root-knot nematode and appeared to be immune to the virus. An interspecific hybridization program was undertaken to transfer the gene for root-knot nematode resistance from N. tomentosa acc. 58 to N. tabacum since it does not appear to be associated with the PVY pathogen. This material may also serve as a source of PVY resistance.

The interspecific hybrid between (8x)NC 2326 and N. tomentosa acc. 58 was made and all F1 plants tested were resistant to the root-knot nematode. The F1 plants were male sterile; however, backcrosses to these plants have been successful and seeds have just recently become available. Testing and backcrossing of this material for root-knot resistance will continue. In addition, materials will be tested for their response to PVY.

E. Leaf chemistry of the Nicotiana Species

With the exception of the cultivated species of tobacco, N. tabacum,

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little is known about the leaf chemistry of the other Nicotiana species. Such information is important, not only for the direct manipulation of the chemical constituents on the leaf, but for the secondary effects on quality, flavor, etc. when these species are utilized as sources of disease or insect resistance.

The entire collection of Nicotiana species, 65 in all, were grown in the greenhouse. At flowering two samples were taken. To study leaf surface chemistry leaves were washed in methylene chloride. This leaf wash is being analysed primarily for diterpenes, fatty alcohols, and wax esters fractions. The second sample consisted of a green leaf sample to determine internal leaf constituents, i.e., organic acids, nitrogen compounds, and sugars. This latter sample was freeze dried, ground to a fine powder, and stored in plastic bags for analysis. Analysis of this material has not been completed.

II. Publications:

Sisson, V. A. and J. A. Saunders. 1983. Catalog of the tobacco introductions in the U. S. Department of Agriculture's tobacco germplasm collection (Nicotiana tabacum). Supplement 1. Alkaloid content of the cured leaf. U. S. Agric. Res. Serv., Agric. Rev. and Man. Ser. (ISSN 0193-3779) No. 27 (Supplement 1).

Li, L. R., V. A. Sisson and S. D. Kung. 1983. Relationship between the kinetic properties and the small subunit composition of Nicotiana ribulose-1, 5-bisphosphate carboxylase. Plant Physiol. 71:404-408.

III. Manuscripts in Review:

Lax, A. R., K.C.Vaughn, V. A. Sisson, and G. E. Templeton. Ferredoxin-$NADP^+$ reductase, a nuclearly coded enzyme unaffected by tentoxin treatment. Photosynthesis Research.

Vaughn, K. C. and V. A. Sisson. Cytoplasmic inheritance of tentoxin-induced loss of polyphenol oxidase activity. Current Genetics.

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CROP SCIENCE

Varietal Evaluation Studies in Flue-Cured Tobacco

Daryl Bowman

I. A. N. C. Official Variety Test - Tobacco (1983)

Twenty-two released varieties and 27 experimental lines were tested at five locations. Included in the experimentals were eight entries of the Regional Farm Test. N. C. 95 and NC 2326 were included as standards in these tests.

Up-to-date information is available on the performance of these varieties in the results of the North Carolina Official Variety Research Report No. 93, dated December 1983 from experiments conducted in 1983. The test locations represent growing conditions in the Border, Eastern, Middle and Old Belts in North Carolina. Research Report No. 93 serves as a guide in helping growers choose their 1984 varieties for planting. Copies of this report are mailed to county extension chairmen, vocational agriculture teachers, seedsmen, and agri-business representatives.

Combined data from the 1983 trials from four locations are shown in Table 1.

B. Regional Minimum Standards Program

The first phase of the Regional Minimum Standards Program consists of the Regional Small Plot Tests which are located on tobacco experiment stations in the flue-cured region. In North Carolina the tests are located at the Border Belt Tobacco Research Station, Lower Coastal Plain Tobacco Research Station and the Oxford Tobacco Research Station.

In 1983, thirty-seven entries were included in the Regional Small Plot Test, along with the two standards--NC 2326 and NC 95. A separate publication giving individual location data and combined data for six locations has been distributed to all committee members and other interested parties. Fourteen lines met the minimum standards in the Regional Small Plot Test and may be advanced to the Regional Farm Test in 1984.

The Regional Farm Test is the final phase of the Regional Minimum Standards Program and in 1983 contained eight lines which were evaluated under code by the Variety Evaluation Subcommittee of the Flue-Cured Tobacco Quality Committee. Six of these breeding lines met the minimum standards. The lines were Coker 206Y, NC 48 (USDA), NC TG-24, NK 94, PD 88, and Speight G-80. These have been evaluated for two years in the Regional Small Plot Test and one year in the Regional Farm Test and have met the standards as prescribed. This makes 69 entries that have met the minimum standards since this program was

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developed. Seed of these six lines may be available for 1985 plantings should the breeder or agency decide to increase the seed. Data from the Regional Farm Test are published annually in the Flue-Cured Tobacco Variety Evaluation Committee Report.

II. Unclassified Graduate Student

Mr. Abdel Bary

IV. Publications

Bowman, Daryl, Tom Corbin and Glenn Tart. "Measured Crop Performance Tobacco 1983." Research Report No. 93, December, 1983.

V. Manuscripts Released for Publication

Bowman, D. T., E. A. Wernsman, T. C. Corbin, and A. G. Tart. Contribution of Genetics and Production Technology to Long-Term Yield and Quality Gains in Flue-Cured Tobacco. Tob. Sci. (In Press).

VII. Papers Presented at Professional Meetings

Bowman, D. T. and J. O. Rawlings. 1983. Incorporating experimental precision into standards set for flue-cured tobacco. Agron. Abstr. 1983:56.

Bowman, D. T. 1983. Influences on yield gains of flue-cured tobacco in North Carolina. 1983 Tobacco Workers Conference, Williamsburg, Va.

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NORTH CAROLINA OFFICIAL VARIETY TESTS
COMPARISON OF VARIETIES IN 1983 FOR CERTAIN CHARACTERISTICS
COMBINED FOR FOUR LOCATIONS: WHITEVILLE, ROCKY MOUNT, OXFORD AND REIDSVILLE

Table 1.

Varieties	Yield Lbs/A	Value Index Dol/A	Value Index Dol/Cwt.	Grade Index	Days to Flower	Leaves per Plant	Height of Plant	Ground Suckers	Nic. %	Sol. Sug. %
Commercially Available Varieties										
NC 2326	2591	4633	179.09	51	55	16.6	43	0.2	3.72	13.28
NC 95	2931	5191	177.16	51	62	18.2	43	1.5	3.57	15.28
Clemson PD4	2946	5278	179.74	54	63	18.9	44	0.2	3.35	14.98
Coker 48	3258	5853	179.68	49	65	19.6	45	0.7	3.60	16.98
Coker 176	2768	4975	179.91	54	66	19.3	41	0.4	3.63	13.20
Coker 209	2715	4870	179.29	56	67	20.5	44	0.2	3.87	13.40
Coker 298	2902	5206	179.40	53	67	18.6	45	0.4	3.87	14.89
Coker 319	2769	5032	182.16	60	62	18.8	43	0.9	3.17	13.94
Coker 347	3191	5631	176.58	47	64	19.8	44	0.9	3.89	14.07
K 326	3128	5767	184.28	59	66	18.5	39	0.2	3.13	14.06
K 399	3010	5373	178.51	54	62	18.9	38	0.2	3.10	14.86
McNair 373	3016	5471	181.60	57	59	20.0	39	0.7	3.43	13.87
McNair 944	3072	5547	180.84	55	63	18.5	42	0.3	3.50	16.92
NC 22NF	2734	4882	179.07	52		19.0	42	0.1	3.30	13.89
NC 50	3029	5376	177.63	50	68	19.1	41	0.1	3.42	13.15
NC 82	2918	5262	180.29	56	59	18.4	41	1.1	3.31	14.16
NC 567	2837	5163	182.01	57	60	17.9	43	0.5	3.55	15.82
NC 628	2860	4962	173.30	44	63	17.6	44	0.3	3.40	13.52
Speight G-28	2810	5069	180.16	60	63	19.9	39	0.1	2.98	13.98
Speight G-58	2942	5182	175.89	49	65	18.9	39	0.3	3.67	14.15
Speight G-70	3126	5695	181.98	52	62	18.3	40	0.7	3.25	15.40
VA 182	2828	5184	183.30	61	63	17.6	42	0.6	3.07	13.82
Eligible for Seed Increase in 1984										
Clemson PD88	3018	5343	177.86	50	65	19.0	46	2.4	3.59	16.59
Coker 206Y	2905	5172	177.32	51	64	18.2	40	0.3	4.11	11.79

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Table 1. (Continued)

Varieties	Yield Lbs/A	Value Index Dol/A	Value Index Dol/Cwt.	Grade Index	Days to Flower	Leaves per Plant	Height of Plant	Ground Suckers	Nic. %	Sol. Sug. %
NC TG-24	2689	4784	178.47	50		18.7	43	0.3	3.38	13.45
NC 48 USDA	2959	5328	180.14	56	64	19.3	43	0.4	3.77	14.71
NK 94	3336	5923	177.32	54	66	19.3	39	0.0	2.89	15.37
Speight G-80	2921	5265	180.14	55	63	18.5	39	0.7	3.32	12.42
Mean of Test[1/]	2978	5341	179.37	54	63	18.8	41	0.6	3.35	14.45
L.S.D. (.05)	240	474	5.00	6	3	1.2	3	0.5	0.37	2.22
C.V. (%)	9	10	3	13	5	7	6	73	12	17

[1/] Statistics based on all 54 entries in 1983 OVT.

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ANNUAL REPORT ON TOBACCO WEED CONTROL RESEARCH

April 1, 1983 - February 29, 1984

Title: Project State NCO-3774, Effective and Efficient Weed Management Programs for Corn, Tobacco, Small Grains and Sorghum.
and
Project State NCO-3569, Vegetation Control in No-tillage Crop Production.

Project Leader: A. D. Worsham, Professor, Crop Science Department, with assistance from Robert L. Davis, Assoc. Ext. Professor, Mountain Research Station, Waynesville, NC; Richard Lemons, Research Assistant; Sandra Doyle, R. J. Reynolds Undergraduate Research Apprentice; and R. F. Walls, Graduate Student.

Abstract: The postemergence grass herbicides, DPXY-6202, fluazifop-butyl, sethoxydim, and Dowco 453 all gave good to excellent control of annual grasses when applied overtop at .12 to .50 lb/A. Yields were increased over cultivated checks and there was no crop injury. Acifluorfen at 1.5 to 2.0 and oxyfluorfen at 0.25 to 0.50 lb/A pre-bed incorporated gave fair to good control of crabgrass and common ragweed and good control of lambsquarters but caused moderate stunting of tobacco. FMC 57020 at 1.0 and 2.0 pre-bed incorporated and overtop gave excellent ragweed control with some injury at the higher rate. AC-252214 at 0.25 to 0.50 lb/A pre-bed incorporated, post-bed incorporated, overtop and early postemergence gave good to excellent control of annual grasses and broadleaf weeds including ivyleaf morningglory. Good crop tolerance was obtained with the post-bed incorporated treatment and early-post overtop treatments. These two herbicides appear promising as giving increased broadleaf control over previously available tobacco herbicides. Isopropalin, pendimethalin, diphenamid and napropamide proved useful in a weed management program in burley tobacco, giving excellent control of large crabgrass, goosegrass, fall panicum, foxtails, common lambsquarters, Pa. smartweed, redroot pigweed, common purslane and copperleaf. Diphenamid and napropamide gave good control of hairy galinsoga but none of the herbicides controlled common ragweed well.

Glyphosate caused increased injury to no-till tobacco when it was used to kill a rye cover crop as rate increased and as the interval between application and planting was reduced from 4 to 2 weeks. Tank mixing with diphenamid also appeared to increase tobacco injury. No-till tobacco did not grow well when planted into a killed crimson clover or hairy vetch cover crop. In a preliminary test, no-till tobacco with a second application of base fertilizer yielded almost twice as much as conventional tobacco, but in general, yields of no-till tobacco were 80 to 85% that of conventional. Soil loss from water erosion in no-till tobacco was 80X less (0.05 vs. 4.03 tons/A) than in conventional tobacco on a sandy loam soil of 3.1% slope. No-till, flat-planted burley tobacco yielded 13% more than conventional burley and no-till, bedded burley yielded 95% of the conventionally-planted.

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I. Summary of Research (Tests in Group 1):

1. General Experimental Methods: Thirteen types of experiments were conducted in the field in 1983. This research will be separated into two major groupings which will be reported in the following order. The first group consists of several different tests involving herbicide evaluations in conventional flue-cured tobacco. The second group consists of several experiments concerned with the production of no-till flue-cured and burley tobacco.

Experiments in Group 1, the herbicide evaluations tests, will be referred to as (A) Post Emergence Grass Herbicide Test, (B) Tobacco Herbicide Evaluation Test, (C) The Effect of Glyphosate on Conventional Tobacco Yields, (D) The Evaluation of AC-252214 in Tobacco, and (E) Burley On-Farm Weed Control Tests.

These tests were conducted at the following research stations: the Central Crops Research Station near Clayton, the Upper Coastal Plain Research Station near Rocky Mount, the Oxford Tobacco Research Station near Oxford, and the Upper Piedmont Research Station near Reidsville. On-farm tests were in the burley area of western North Carolina.

Product description, including chemical names, common names and manufacturers of compounds used in 1983 are given in Table 1. Other detailed information (such as soil description, tobacco varieties, and treatment dates) is included in the narrative with each test. These narrative data tables are in the Appendix, along with weather data tables.

Herbicide treatments were applied broadcast with a CO_2 pressurized backpack sprayer having five whirl-chamber nozzles on a boom at 20-inch spacings. The sprayer was operated at 3 mph and 20 psi to deliver 19.1 gal/A. For incorporated treatments, herbicides were disked in immediately after application with a tandem disc harrow set to cut 4 to 6 inches deep and operated at 4 mph. Two lengthwise trips were made down and back in each plot with the disc. A one-row power-driven rotary hoe was used to incorporate treatments on top of the beds. The overtop treatments were applied to the plots immediately after transplanting. Post treatments were applied overtop to the plants three to four weeks after transplanting. Any variations in methods will be given in specific methods for each test.

The tobacco was grown according to standard practices and was harvested and cured by flue-cured or burley methods. All tobacco on the research stations was irrigated as needed except at the Kinston location. An official grader rated the tobacco by plot and by priming. The average price per grade from September of 1982 to September of 1983 was used in calculating the value per acre for the treatments. Some of the tests were analyzed for certain chemical constituents in the cured leaf. The analyses were performed in the Crop Science Department tobacco chemistry laboratory.

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All in-field ratings of experiment plots were made independently each time by two persons and these values were averaged to obtain a rating for a particular plot. Weed control ratings are based on a 0 to 100 scale; 0 = no control and 100 = perfect control. Injury ratings are based mainly on stunting of tobacco plants unless otherwise specified (0 = no injury, 100 = crop kill).

Rainfall data for the tobacco research locations are given in Appendix Tables 14 through 19.

A. Postemergence Grass Herbicide Test -- The herbicides used are listed in Tables 2 and 3. A randomized complete block design with 4 replications each was ued at both the Rocky Mount and Oxford locations. The plots were 45 feet in length and contained three 48-inch rows. Plant density was later cut back to approximately 20 plants per row. Tobacco was transplanted and left without cultivation for approximately three to four weeks. When the grass was 2 to 4 inches in height, all treatments were applied broadcast directly over the top of the tobacco.

After the layby cultivation, two treatments consisted of a broadcast application of Fusilade applied using a two-nozzle boom directed to the row middles and base of the plants with the chemical coming in contact with the lower leaves.

Weed control ratings at Rocky Mount for the overtop treatments were based on large crabgrass at 1-3/sq. ft. and goosegrass <1/sq. ft. (1-2"). At the Oxford location, weeds present were large crabgrass (1-3/sq. ft) on row edges, (3-5/sq. ft.) in row middles and on top of the beds. Broadleaf weeds were abundant at both locations. Since these herbicides do not affect broadleaf species, evaluations on them were omitted, but most were removed by hand prior to harvest.

Results: At the Rocky Mount location, dry weather placed stress on the tobacco and grass plants and the first ratings were obtained before maximum control was obtained. Grass control was poor at this time except fair control was obtained with fluazifop-butyl at .5 lb ai/A. However, after cultivations, both large crabgrass and goosegrass ratings were very good to excellent at mid-season. A second application of fluazifop-butyl in mid-season did improve grass control slightly, especially in late season. There was no crop injury observed throughout the growing season. All treatments did out yield and brought a higher $/A value than did the cultivated and the uncultivated checks. There were no significant differences in the quality index values.

At the Oxford location, all treatments gave excellent early-season control of large crabgrass, except the low rate of sethoxydim at .10 lb ai/A which was rated very good. Treatments gave very good to excellent control throughout the growing season. There was no crop injury observed throughout the growing season. Tobacco yields were very poor at this location due to dry weather and other unknown production problems. However all treatments did yield more than

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cultivated checks and therefore $/A were greater for all the treatments. There were no significant differences in $/cwt and the grade index among treatments.

B. Tobacco Herbicide Screening Test -- The herbicides used are listed in Tables 4, 5, and 6. A randomized complete block design was used at two locations, Reidsville and Oxford, with 3 and 4 reps., respectively. Both tests received two cultivations during the growing season.

Weed control and injury ratings were taken throughout the growing season. Weed control ratings at Reidsville were based on large crabgrass (>10/sq. ft.), and common lambsquarter (1/sq. ft.). Injury ratings were based on percent stunting (0 = no injury and 100 = complete kill). Also interveinal bleaching on the lower leaves was noted with certain treatments and by number of replications in which it occurred.

Results: At the Reidsville location, acifluorfen at 1.5 and 2.0 lb ai/A gave very good early season crabgrass control and the 2.0 lb ai/A rate gave very good season long crabgrass control. All rates of acifluorfen gave very good to excellent season long control of common lambsquarter. Oxyfluorfen at .25, .30 and .50 lb ai/A gave good early season control of large crabgrass but at mid- and late-season only, the higher rate (.5 lb ai/A) was giving good control. Common lambsquarter control was good throughout the season with the .30 and .50 lb ai/A rates of oxyfluorfen. Both acifluorfen and oxyfluorfen stunted the tobacco moderately in the early season. There were no significant differences in yield and $/A among treatments, however, the cultivated check and FMC 57020 at 1.0 lb ai/A gave the poorest yield of all treatments. There was no significant difference in the grade index (Table 6).

At the Reidsville location, all standard tobacco treatments gave very good to excellent control of large crabgrass and common lambsquarter in early season. Pendimethalin and isopropalin did give better mid- and late-season control of large crabgrass and lambsquarter than did the napropamide and diphenamid treatments. There was no significant difference between the standard treatment yields, they were all higher than the cultivated check (Table 6).

At the Oxford location, acifluorfen at 1.5 and 2.0 lb ai/A gave fair early-season crabgrass control and very good season-long control of common ragweed. All rates of acifluorfen gave moderate stunting by mid-season but recovered by late-season and out-yielded the cultivated check. Oxyfluorfen at all rates gave poor control of large crabgrass with only the .5 lb ai/A rate performing good on common ragweed. Some mid-season stunting was observed but did not effect yields (Table 6). FMC 57020 at 2.0 lb ai/A PBI gave excellent control of large crabgrass and common ragweed. FMC 57020 at 1.0 lb ai/A PBI also gave excellent common ragweed control but was only fair on crabgrass control in early-season. FMC 57020 at 1.0 and 2.0 lb ai/A O.T. gave excellent early-season crabgrass control and at 2.0 lb ai/A performed well throughout the season. Both rates, 1.0 and 2.0 lb ai/A gave excellent early-season common ragweed control. FMC 57020 at

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2.0 lb ai/A PBI moderately stunted tobacco at mid-season. Both rates and methods of application of FMC 57020 gave light interveinal bleaching in the lower leaves, but this did not effect the yields nor the grade index (Table 6). Prowl gave better early-season large crabgrass control compared with the other standards. Isopropalin, diphenamid, and napropamide did not perform as well as would have been expected on early season grasses. Common ragweed weed control was poor to fair with all the standard tobacco herbicides. There was no significant injury. With dry conditions, yields and quality at this location were poor.

C. The Effect of Glyphosate on Conventional Tobacco Yields -- The rates of glyphosate used and yields are given in Table 7.

This test was designed to see if we could achieve a yield increase in tobacco with low rates of glyphosate applied over the top four weeks after transplanting. A randomized complete block design with 4 replications was used at the Clayton location. The plots were 45 feet in length and contained three 48-inch rows. Plant density was later cut back to approximately 20 plants per row. Tobacco was transplanted and four weeks after transplanting the overtop applications were made. Tobacco was grown and harvested with standard practices.

Results: The only significant difference was that the 0.3 lb ai/A rate of glyphosate injured the tobacco and had significantly lower yields than the treatments in the rest of the test. We were surprised that this rate did not kill the tobacco and it recovered to yield as well as it did.

Other crops have shown yield increases from minute postemergence application and perhaps timing of application could be an important factor with tobacco yield. Timing and other methods of application could be studied in the future.

D. The Evaluation of AC-252214 in Tobacco, Clayton and Reidsville, NC, 1983 -- General methods.

AC-252214 was evaluated at three rates (.25, .38, and .5 lb ai/A) at both Clayton and Reidsville during 1983. AC-252214 was applied by four methods for all three rates. The methods of application were (1) preplant, pre-bedding incorporated, (2) post-bed incorporated, (3) overtop, and (4) early postemergence.

Results: AC-252214 at all rates and application methods provided excellent early- and late-season broadleaf and grass control at both locations.

Common lambsquarter and redroot pigweed control was very good to excellent with all treatments at Clayton and Reidsville. Late season control of ivyleaf morningglory was very good to excellent at Reidsville for all rates and methods of application.

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Generally, all rates of AC-252214 and methods of application provided very good to excellent broadleaf control at both locations. However, lambsquarter control at the Clayton location in the early post treatments was rated only as good.

Large crabgrass control was rated as good to excellent at both locations for all AC-252214 treatments.

Crop tolerance data indicate that 50-70% stunting of tobacco in early season was observed from the AC-252214 PPI treatments. However, yield data indicate that all treatments produced yields equal to the control except the .5 lb ai/A pre-bed incorporated.

Good crop tolerance was observed from the post-bed incorporated treatments at both Clayton and Reidsville. Overtop and early-post treatments caused slight to moderate stunting of tobacco in early season.

Yield and Quality: Yield per acre, price and value per acre were generally good at the Clayton and Reidsville locations. Results from most treatments did not differ significantly from the control. Further work should be done to determine the potential of this compound for weed control in tobacco.

E. Burley On-Farm Weed Control Tests -- Cooperating with R. L. Davis, Burley Extension Specialist, 12 on-farm tests were put out in 10 counties in the burley producing area in western North Carolina. Herbicides used are shown in Table 8. Rates used were: Prowl (1.0 lb ai/A), Devrinol (2 lb ai/A), Enide (6 lb ai/A), and Paarlan (1.5 lb ai/A). Plot size was 16 ft. (4 rows) by 40 ft. with three replications. Weed control ratings were taken about 21 days after transplanting and before the first cultivation. Herbicides were applied as recommended.

Results: Relatively poor control of common ragweed was obtained with all herbicides tested (43-64%). Poor control, 44 and 53%, of hairy galinsoga was obtained with Paarlan and Prowl, respectively. Enide and Devrinol gave good control this year, 83 and 82%. Control of the annual grasses, crabgrass, goosegrass, fall panicum and foxtail was good to excellent (78 to 97%) with all herbicides. Paarlan averaged slightly lower in control than the other herbicides.

Good to excellent (76-95%) control of common lambsquarter, Pa. smartweed, redroot pigweed, common purslane and copperleaf was obtained with most of the herbicides. Paarlan gave fair to poor (63%) control of purslane.

These results show that the available herbicides for burley will help in a weed management program. If weather conditions are favorable (high rainfall) fair to good control of the problem weed, hairy galinsoga, could be expected from Devrinol or Enide. Common ragweed control would still usually be poor, but partial control could be expected under ideal conditions.

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I. Summary of Research (Tests in Group 2):

1. General Experimental Methods: The second group of experiments was designed to evaluate the feasibility of growing no-till tobacco, to study soil erosion differences between no-till and conventionally-planted tobacco, study weed control and the effect on weed control of various mulch-tillage combinations. Land was prepared, soil treatments (soil insecticide/nematicide or multi-purpose fumigant depending on location) applied, and land was bedded in the fall. Small grain and legume cover crops were sown and seed covered with a rolling cultivator adjusted to fit the beds. Approximately two weeks before transplanting, grain was killed with glyphosate or paraquat. Tobacco was transplanted using a modified commercially available no-till one-row transplanter. The transplanter was equipped with a double-disk opener and wide, rubber tired press wheels on an articulating frame. A coulter in front of the opener was used where mulch was heavy. Tobacco was fertilized by side-dressing with 40 N - 40 P_2O_5 - 120 K_2O at planting and addition of 25 units of N was sidedressed later in the season. Variations in some tests are noted.

All background information is included in the narrative reports for each herbicide test. Any variations in methods will be given in specific description of each test.

The tests will be referred to as (F) Glyphosate Rate and Time of Application Test in No-till Tobacco, (G) Interaction Study with Glyphosate and Diphenamid in No-till Tobacco, (H) No-till Tobacco in Legume Covers, (I) Preliminary Fertilization Test in No-till Tobacco, (J) Time of Application and Transplanting Test in No-till tobacco, (K) Soil Erosion Evaluation, and (L) No-till Burley Tobacco Test. These tests were conducted at the following research stations: the Central Crops Research Station near Clayton, the Lower Coastal Plain Research Station near Kinston, the Upper Coastal Plain Research Station near Rocky Mount, and the Mountain Research Station near Waynesville.

F. Glyphosate Rate and Time of Application Test -- Herbicides used are listed in Table 9. The objective of this test was to determine if timing of application with glyphosate for rye kill would have an effect on degree of tobacco injury. A randomized complete block design with 4 replications was used at both the Kinston and Rocky Mount locations. Applications to kill the rye cover were made either one month or two weeks before transplanting.

Results: At the Kinston location, rye kill with all treatments was 100%. Goosegrass control was fair for all treatments. Redroot pigweed control ranged from poor to very good control. After the July rating, the test was mechanically weeded with a "weed eater."

When the rye was treated two weeks before transplanting, the injury was significantly higher than the one month prior application

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

date. In all cases, the 3.0 lb ai/A rate of glyphosate injured the tobacco more severely than the 1.5 lb ai/A rate.

Because of dry weather conditions and no irrigation at this location, yields were very poor and showed no significant differences.

At the Rocky Mount location, rye kill with all treatments was 100%. There were no significant differences in weed control. However, when glyphosate was applied one month before transplanting, some weeds emerged before the diphenamid was applied and therefore poorer control was obtained.

Even though injury was not statistically significantly different, all two-week before transplanting applications had greater injury especially the 3.0 lb ai/A rate of glyphosate.

Because of poor growth of the tobacco, only green weight yields were obtained. There were no significant differences among treatments.

G. Interaction Study with Glyphosate and Diphenamid in No-till Tobacco -- Herbicides and yields are listed in Table 10. This test was designed to see if there were any adverse effects on tobacco injury when glyphosate was tank-mixed with diphenamid at time of rye kill. A randomized complete block design was used at the Rocky Mount and Clayton locations with three and four replications, respectively.

Results: Even though yields are not significantly different, all glyphosate treatments averaged lower in yields than the paraquat treatments. Also, at the Clayton location, the tank-mix combination of glyphosate plus diphenamid yielded half as much as the sequential application of glyphosate plus diphenamid. This suggests that there may be an antagonistic effect from the tank mix application and future studies are needed to resolve this question.

H. No-till Tobacco in Legume Covers -- Herbicides used and yields obtained are listed in Table 11. Objectives were to determine if legume cover crops would supply no-till tobacco with adequate nitrogen and provide an effective mulch cover for no-till tobacco production compared with a rye cover crop.

Results: An excellent stand of common vetch, crimson clover, and rye was established in the fall of 1982 for this test. Cover kill applications were made approximately three weeks before transplanting. We did not achieve complete kill of either clover or vetch with the first application of either herbicide. A second application of paraquat at .5 lb ai/A over all legume plots was used one week before transplanting and complete kill was then obtained. After the first transplanting, stands were poor at both locations. A second transplanting achieved fair stands. Fertilizer was applied to the rye and the conventional plots but not to the vetch and clover plots. From previous work with legume cover crops in other no-till, we felt that 60 to 80 lb/A N should have been supplied by the clover or vetch and felt that

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

additional N would have been unnecessary. Soil tests showed high P and K levels. After two weeks at both locations, tobacco in the vetch and clover plots was a darker green compared to the rye and conventional tobacco plots, with little difference in growth. However, one month after transplanting tobacco in the vetch and clover plots at both locations had begun to yellow from lack of fertilization or N. Also both clover and vetch mulches had almost completely disintegrated, leaving the soil almost bare.

Due to poor growth of tobacco in the vetch and clover plots, yields were not obtained. We did harvest the rye no-till and the conventional plots at the Clayton location to compare the two treatments.

I. Preliminary Fertilization Test in No-till Tobacco -- Herbicides used and yields obtained are listed in Table 12. The objective of this test was to determine if a higher than normal rate of base fertilizer would improve no-till tobacco. A stripped, randomized complete block design with two replications was used at the Clayton location. Standard fertilization practice at this location consists of 40 lb N, 40 lb P_2O_5 and 120 lb/A K_2O being applied as a side band placement about one week after transplanting. An additional 25 lb/A N is usually applied as a sidedress treatment two to three weeks after transplanting. This was done in the conventional no-till plots and conventionally-tilled plots. In the high fertilization treatment, the normal rate of complete fertilizer was applied soon after transplanting and another application of the same rate applied as a sidedressing later in the season.

All treatments received diphenamid (6.0 lb/A) overtop and paraquat (0.5 lb/A) was used for rye kill in the no-till plots.

Results: There were no significant differences in yields although the high fertilizer treatment yield was almost double the yield of the standard fertilization no-till or conventionally-tilled plots. A high amount of variability and only two replications reduced the likelihood of statistically significant differences. Further work on fertilization of no-till tobacco needs to be done.

J. Time of Application and Planting Test in No-till Tobacco -- Herbicides and yields are listed in Table 13.

The objective of these experiments was to determine if time of application and timing of transplanting affected the severity of glyphosate injury on no-till tobacco. Randomized complete block designs with 4 replications each were used at both the Clayton and Kinston locations.

Results: At the Clayton location, there was no significant difference in weed control by mid-season. In July, green leaf weight yields were obtained and all early-transplanted no-till tobacco yields were significantly higher than the later transplanted yields. Also, all paraquat treatments had a higher average yield than the glyphosate

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

treatments thus still reflecting the glyphosate injury in no-till tobacco if cover crops are treated prior to transplanting.

At the Kinston location, all tobacco in this experiment had to be reset after extremely poor stands in the no-till and conventional tobacco. After the late transplanting, dry conditions and no irrigation at this location, tobacco did not produce differences in weed control or injury, and the tobacco was too poor to harvest, so this test was abandoned.

K. Soil Erosion Evaluation for No-till Tobacco --

Methods: Eight 113.6 L (30 gallon) metal barrels were prepared for collecting runoff and sediment by cutting the tops in half and then hinging them in place. The hinged tops prevented rainfall from falling into the barrels and were propped open 10 cm (4 inches) to allow the runoff to flow into the barrel. Each barrel was 76 cm (30 inches) deep and 46 cm (18 inches) wide with a volume of 128,842 cm^3 (7861 $inches^3$). Collected runoff water flowed from one half of two adjacent rows and was channeled into the barrel by galvanized metal skirts attached to the lip of the barrel and extending to the crest of the ridged row. Sand cement was spread around the skirting and the immediate entrance to the barrel. V-shaped galvanized metal sheets were secured into the ground 14.3 m (47 feet) from the barrels to function as sample plot borders and surface water barriers. Row ridges were approximately 30 cm (12 inches) tall and served as borders along the plot length.

Each collection plot measured 1.2 m x 14.3 m (4 ft. x 47 ft.). The four foot plot width is a standard tobacco row width. Total area for the four replciations in conventional and no-till treatments was 1/143 of a hectare (4.9 m x 14.3 m) [1/58 of an acre (16' x 47')]. Average slope for the test was 3.1%. Soil types in the collection area were a Goldsboro loamy sand on the upper range and a Bibb series on the lower end of the field.

For no-till production, a rye cover crop was sown on rows bedded in the fall. The rye cover was treated with paraquat (.5 lb ai/A) two weeks prior to transplanting the tobacco. Tobacco was transplanted on the 12th of May and the barrels were placed in the ground the same day. Diphenamid was broadcast at 6.7 kg/ha (6.0 lb/A) for weed control immediately after transplanting.

The conventional test was cultivated three times in June. A hand broadcast application of 8-8-24, 1120 kg/ha (500 lb/A) was applied June 2, 1983, on both no-till and conventional and once again June 16, 1983, at the same rate with a tractor-mounted fertilizer distributor.

Sample collections were made after each significant rainfall, >1.3 cm (>.5 in.). Depth of water in each barrel was measured and recorded before drawing the samples. Two-liter samples were taken from each barrel after the contents were thoroughly stirred to suspend the sediment.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Samples were filtered through a Buchner funnel and 9.0 cm glass microfibre filter paper. Samples were dried 24 hours at 100°C, then cleaned of plant material and stones, if present, before determining dry weight. The percent sample taken from each barrel was obtained by dividing 2 L by the measured volume of water for each barrel. Total weight of soil per barrel was calculated by dividing grams of soil (dry weight) by percent sample. Totals for each treatment were then calculated and converted to total soil lost.

Results: Data for 1983 show a dramatic difference in soil loss between the two methods (Table 14) of tobacco production. An unusually heavy rain, 13.2 cm (5.2 inches), fell within less than a 24-hour period, accounting for substantial differences in the first collection of 1983. When a normal rainfall occurred after cultivations, there was an increase in sediment collected from the conventional plots. Runoff was generally greater in the no-till plots than in the conventional. Tobacco yield and quality differences have been recognized in herbicide evaluation tests and these differences were examined this year between the no-till and conventional plots of this study. The yield reduction in no-till averages about 20% less than the conventional; whereas quality in no-till is higher on lower leaves and about the same for the upper leaves. This difference is important in determining the potential for the no-till process in flue-cured tobacco.

Loss of soil between the two treatments in 1983 was 80 times greater in the conventionally tilled tobacco compared with the no-tillage tobacco. Soil loss in the no-till plots averaged 0.05 T/A while soil loss in the conventional plots was 4.03 T/A. Yield of the no-till tobacco was 1707 lb/A compared to 1962 lb/A for the conventional. Thus the no-till tobacco produced 87% of the yield of conventional tobacco in these tests. No-till tobacco definitely reduces soil erosion and with further work it should be able to be adopted by growers in the near future.

L. No-till Burley Tobacco Tests -- Herbicides and yield are listed in Table 15. This test was designed to determine which cultural production practices are more suited for growing no-till burley tobacco as far as land preparation in the fall (flat vs. bedded), and compare yields to conventionally grown burley. A randomized complete block design was used with 4 replications. Rye was used for the mulch cover. Herbicide treatments included paraquat at .05 lb ai/A plus diphenamid at 3.0 lb ai/A at grain kill and diphenamid at 3.0 lb ai/A over the top after transplanting. In mid-season, sethoxydim at .10 lb ai/A was directed in row middles to control escaping grasses.

Results: Two weeks after rye kill, the tobacco was transplanted. Transplanting was easier in the flat culture no-till burley compared to the bedded. The beds were small and it was difficult to maintain the transplanter on top of the beds. However, after hand-setting missed plants, a good stand was achieved in all treatments. About one month after transplanting, etch virus appeared in the no-till and conventional burley, with the no-till burley showing more incidence of the disease.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

About one-third of the no-till tobacco compared to one-eighth of the conventional was infected. The difference in virus infection could be due to the fact that the conventional burley recovered quicker after transplanting and was healthier when virus was transmitted to the area. It is possible that the virus-carrying aphids were attracted more to the smaller, more yellow tobacco with dead mulch showing, than the larger, greener conventionally-tilled tobacco.

Because the test was affected by virus, yields were obtained by randomly harvesting 40 healthy plants per cultural method. Even though statistical analyses were not possible, results were promising. The no-till flat-planted burley out-yielded the conventional burley by 13%. The no-till, bedded yielded 95% of the conventional burley.

II. Graduate Students:

A. Donn G. Shilling, "The Suppression of Certain Weed Species by Rye (Secale cereale L.) Mulch and Isolation, Characterization and Identification of Water-soluble Phytotoxins from Rye."

R. F. Walls (Co-Chairman), "The Potential of AC-252214 for Weed Control in Tobacco."

B. Sandra Doyle, R. J. Reynolds Undergraduate Research Apprentice, "The Potential for Soil Erosion Savings in Flue-cured Tobacco through Conservation Tillage."

III. Postdoctoral Fellows: None

IV. Publications:

Shilling, D.G. and A.D. Worsham. 1983. The effect of mulch and tillage on weed control in tobacco. Proc. South. Weed Sci. Soc. 36:404.

V. Manuscripts Accepted for Publication: None

VI. Manuscripts in Review:

Shilling, D.G. and A.D. Worsham. The effects of mulch, tillage and herbicides on weed control, yield and quality in flue-cured tobacco (Nicotiana tabacum L.). Weed Sci.

Shilling, D.G. and A.D. Worsham. The suppression of certain weed species by rye (Secale cereale L.) mulch and isolation, characterization and identification of water-soluble phytotoxins from rye. Jour. of Agric. and Food Chemistry.

VII. Papers Presented at Professional Meetings:

Shilling, D.G. and A.D. Worsham. The effect of mulch and tillage on weed control in tobacco. South. Weed Sci. Soc., January, 1983.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Worsham, A.D. The potential for conservation tillage. Cons. Tillage Symp., Auburn, AL, October, 1983.

Worsham, A.D. The potential for no-till tobacco. Soil Cons. Serv. Meeting, Bright Leaf Erosion Project, Snow Creek, VA, March, 1983.

Doyle, Sandra and A.D. Worsham. The potential for soil savings in flue-cured tobacco through conservation tillage. Soil Cons. Serv. of Amer. Ann. Meeting, Hartford, CT, August, 1983.

VIII. Graduate Student Theses Completed During the Reporting Period:

Shilling, D.G. "The Suppression of Certain Weed Species by Rye (Secale cereale L.) Mulch and Isolation, Characterization, and Identification of Water-soluble phytotoxins from Rye."

IX. Acknowledgements:

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 1. Herbicides used in 1983, Tobacco Weed Control.

Company	Common name or designation	Trade name or other designation	Formulation	Chemical name
American Cyanamid	pendimethalin	Prowl	4.0 lb/gal EC	N-(1-ethylpropyl)-2,6-dinitro-3,4-xylidine
American Cyanamid	AC 252214	Scepter	75DF	
BASF	sethoxydim	Poast	1.53 EC	[2-(N-ethoxybutyrimidoyl)-5-(2-Thylthiopropyl)-3-hydroxy-2-cyclohexan-1-one]
Chevron	paraquat	Paraquat	2.0 lb/gal	1,1-dimethyl-4,4-bipyridinium salt
Chevron	surfactant	X-77 Spreader		
Dow	Dowco 453		2.0 lb/gal	
DuPont	DPXY 6202	Assure	.8 lb/gal	
Elanco	isopropalin	Paarlan	6.0 lb/gal	2,6-Dinitro-N-N-dipropylcumidine
FMC	FMC 57020	Dimethazone	4 EC	2-(2-chlorophenyl)methyl-4,4-dimethyl-3-isoxazolidione
Helena		Agridex		Crop oil concentrate
ICI	fluazifop	Fusilade	2.0 lb/gal	butyl-2-[4-(6-trifluoromethyl-2-pyridyloxy) phenoxy]propionate
Monsanto	glyphosate	Roundup	4.0 lb/gal	N-(phosphonomethyl)glycine
Rohm & Haas	acifluorfen	Blazer	2.0 lb/gal S	5-(2-chloro-4-(trifluoromethyl)phenoxy)-2-nitrobenzonic acid
Rohm & Haas	oxyfluorfen	Goal	2.0 lb/gal	2-chloro-1-(3-ethoxy-4-nitrophenoxy)-4-(trifluoromethyl) benzene
Stauffer	napropamide	Devrinol	50W	2-(a-napthoxy)-N,N-diethylpropionamide
Upjohn	diphenamid	Enide	50W or 90W	N,N-dimethyl-2,2-diphenylacetamide

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Source: https://www.industrydocuments.ucsf.edu/docs/hgyk0000

Table 2. Postemergence Grass Herbicide Test, Rocky Mount, NC, 1983.

Tr. No.	Herbicide	Rate lb ai/A	Method appl.	Ave. % control: Large crabgrass 6/20	Large crabgrass 7/27	Large crabgrass 9/12	Goosegrass 6/20	Goosegrass 7/27	Goosegrass 9/12	Ave. % injury (Stunting) 6/20	7/27	9/12	Ave. yield and quality: #/A	$/A	$/cwt.	Grade index	% sugar	% TA
1	DPXY 6202 plus X-77	.5 .25	OT	49	83	69	40	84	93	0	0	0	2371	4173	174.48	51	16.1	2.78
2	DPXY 6202 plus X-77	1.0 .25	OT	43	88	78	25	85	88	0	0	0	2549	4386	171.53	49	14.6	2.97
3	Fusilade plus Agridex	.25 1%	OT	53	93	88	60	90	85	0	0	0	2550	4456	175.43	51	16.2	2.67
4	Fusilade plus Agridex Fusilade plus Agridex	.25 1% .25 1%	OT LBY	30	97	96	30	95	99	0	0	0	2483	4339	175.45	50	13.5	2.96
5	Fusilade plus Agridex	.50 1%	OT	58	96	94	40	95	85	0	0	0	2448	4263	173.60	54	16.3	2.70
6	Fusilade plus Agridex Fusilade plus Agridex	.50 1% .50 1%	OT LBY	76	99	98	64	98	94	0	0	0	2671	4701	175.89	52	14.7	3.01
7	Poast plus Agridex	.10 1%	OT	55	87	81	45	86	80	0	0	0	2249	3949	176.12	51	15.7	2.69
8	Poast plus Agridex	.20 1%	OT	65	88	79	50	89	79	0	0	0	2372	4167	176.61	52	15.9	2.76
9	Dowco 453 plus Agridex	.06 1%	OT	68	88	90	56	84	83	0	0	0	2454	4268	173.78	50	15.3	2.90
10	Dowco 453 plus Agridex	.12 1%	OT	69	87	82	61	86	83	0	0	0	2175	3756	173.22	53	16.5	2.74
11	Check - Cult.	---	--	0	38	35	0	43	35	0	0	0	1820	3200	176.50	56	16.6	2.60
12	Check - Uncult.	---	--	3	0	0	0	0	0	0	0	0	1447	2490	171.27	58	18.3	1.88
		LSD .05		28	18	26	43	16	18	0	0	0	402	914	NS	NS	NS	NS
		CV (%)		42	15	19	68	21	12	*	*	*	19	22	10	11	24	27

* = Interveinal bleaching (light) and no. of reps. showing lower leaves 1-3 plants/plot.

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Source: https://www.industrydocuments.ucsf.edu/docs/myk00000

Table 3. Postemergence Grass Herbicide Test, Oxford, NC, 1983.

Tr. No.	Herbicide	Rate lb ai/A	Method appl.	Ave. % control Large crabgrass 6/27	7/29	9/13	Ave. % injury (Stunting) 6/27	7/29	9/13	Ave. yield and quality #/A	$/A	$/cwt.	Grade index
1	DPXY 6202 plus X-77	.5	OT	96	94	89	0	0	0	1152	1830	158.87	34
2	DPXY 6202 plus X-77	1.0	OT	98	99	95	0	0	0	1226	1888	154.00	33
3	Fusilade plus Agridex	.25 1%	OT	98	97	94	0	0	0	1231	1968	159.87	34
4	Fusilade plus Agridex Fusilade plus Agridex	.25 1% .25	OT LBY	97	99	99	0	0	0	1486	2364	159.08	31
5	Fusilade plus Agridex	.50 1%	OT	96	98	96	0	0	0	1026	1526	148.76	27
6	Fusilade plus Agridex Fusilade plus Agridex	.50 1% .50	OT LBY	98	99	99	0	0	0	1356	2103	155.07	29
7	Poast plus Agridex	.10 1%	OT	92	90	88	0	0	0	1288	2052	159.32	31
8	Poast plus Agridex	.20 1%	OT	98	96	94	0	0	0	1146	1831	159.79	31
9	Dowco 453 plus Agridex	.06 1%	OT	96	95	96	0	0	0	1293	2022	156.34	34
10	Dowco 453 plus Agridex	.12 1%	OT	99	98	94	0	0	0	1444	2365	156.87	30
11	Check - Cult.	---	--	0	5	0	0	0	0	741	1140	153.88	28
12	Check - Cult.	---	--	0	8	0	0	0	0	911	1431	157.05	28
	LSD .05			5	11	13	0	0	0	441	932	NS	NS
	CV (%)			32	21	24	*	*	*	26	19	15	9

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Source: https://www.industrydocuments.ucsf.edu/docs/nyk00000

Table 4. Tobacco Herbicide Evaluation Test, Oxford, NC, 1983.

Tr. No.	Herbicides	Rate lb ai/A	Method appl.	Ave. % control: Large crabgrass June 6	Large crabgrass July 14	Large crabgrass Sept. 19	Common ragweed June 6	Common ragweed Sept. 19	% injury (Stunting) June 6	% injury (Stunting) July 14	% injury (Stunting) Sept. 19
1	Blazer	1.0	PBI	58	69	69	88	71	3	10	3
2	Blazer	1.5	PBI	70	68	87	90	92	3	20	0
3	Blazer	2.0	PBI	73	74	85	91	93	3	16	0
4	Goal	.25	PBI	36	59	74	70	45	0	1	0
5	Goal	.30	PBI	10	60	75	65	56	0	20	8
6	Goal	.50	PBI	59	49	77	83	56	0	8	3
7	FMC 57020	1.0	PBI	76	97	93	97	99	0*	8	4
8	FMC 57020	2.0	PBI	100	98	96	100	99	0***	27*	0
9	Paarlan	1.5	PBI	69	93	92	58	61	0	8	0
10	Prowl EC	1.0	PBI	86	91	99	70	35	0	3	0
11*	FMC 57020	1.0	OT	100	90	69	100	53	0****	1	3
12*	FMC 57020	2.0	OT	98	93	93	98	67	0*	3	0
13	Devrinol	1.0	OT	79	71	93	70	53	5	3	0
14	Devrinol	1.0	PBI	68	90	96	56	68	0	0	0
15	Enide	6.0	OT	79	50	88	74	66	0	0	0
16	Check (Cult.)	--	--	23	26	30	50	31	3	4	4
	L.S.D. .05			10	18	15	16	22	NS	NS	NS
	% C.V.			16	21	18	21	32	45	62	51

* = Interveinal bleaching (light) and no. of reps. showing lower leaves (one to three plants/plot).

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Source: https://www.industrydocuments.ucsf.edu/docs/hfyk0000

Table 5. Tobacco Herbicide Evaluation Test, Reidsville, NC, 1983.

Tr. No.	Herbicides	Rate lb ai/A	Method appl.	Ave. % control						% injury (Stunting)	
				Large crabgrass			Common lambsquarter				
				June 23	Aug. 25	Oct. 6	June 23	Aug. 25	Oct. 6	June 23	Aug. 25
1	Blazer	1.0	PBI	85	68	51	92	96	85	13	3
2	Blazer	1.5	PBI	94	77	57	99	99	83	25	5
3	Blazer	2.0	PBI	96	85	86	96	99	96	25	3
4	Goal	.25	PBI	83	50	58	87	78	88	15	5
5	Goal	.30	PBI	82	75	58	82	94	80	12	2
6	Goal	.50	PBI	80	83	80	82	94	91	8	0
7	FMC 57020	1.0	PBI	98	93	83	99	99	95	3	5
8	FMC 57020	2.0	PBI	98	91	93	99	99	97	0	5
9	Paarlan	1.5	PBI	99	93	98	98	99	99	17	2
10	Prowl EC	1.0	PBI	99	95	98	98	99	98	7	0
11*	FMC 57020	1.0	OT	97	91	87	95	99	92	5***	5
12*	FMC 57020	2.0	OT	100	82	70	99	99	91	12***	0
13	Devrinol	1.0	OT	85	77	77	85	98	96	8	0
14	Devrinol	1.0	PBI	97	78	69	96	99	92	0	2
15	Enide	6.0	OT	90	73	69	92	99	92	5	0
16	Check (Cult.)	--	--	0	17	27	0	50	33	0	0
	L.S.D. .05			15	22	15	12	15	12	NS	NS
	% C.V.			17	15	32	22	15	10	50	62

* = Interveinal bleaching (light) and no. of reps. showing lower leaves 1-3 plants/plot.

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 6. Tobacco Herbicide Evaluation Test, Reidsville and Oxford Locations, 1983.

Tr. No.	Herbicides	Rate lb ai/A	Method appl.	Oxford location (Average)				Reidsville location (Average)					
				#/A	$/A	$/cwt.	Grade Index	#/A	$/A	#/cwt.	Grade Index	% sugar	% TA
1	Blazer	1.0	PBI	1840	2960	160.87	35	2349	4054	172.63	41	11.8	2.88
2	Blazer	1.5	PBI	1915	2939	153.46	30	2152	3715	172.12	42	8.1	3.04
3	Blazer	2.0	PBI	1928	3008	156.00	30	2192	3787	172.69	44	9.1	2.51
4	Goal	.25	PBI	1778	2839	159.69	31	2283	3940	172.58	46	13.3	2.47
5	Goal	.30	PBI	1652	2583	156.33	25	2660	4684	176.09	46	11.5	2.75
6	Goal	.50	PBI	1715	2720	158.57	29	2377	4123	173.24	42	14.1	2.45
7	FMC 57020	1.0	PBI	1588	2516	158.42	30	1834	3124	170.42	41	13.1	2.85
8	FMC 57020	2.0	PBI	2010	3225	160.44	32	2095	3590	171.15	42	12.7	2.66
9	Paarlan	1.5	PBI	1680	2671	158.97	27	2543	4433	174.32	43	12.8	2.57
10	Prowl EC	1.0	PBI	2048	3267	159.52	31	2362	4099	173.54	45	14.1	2.61
11	FMC 57020	1.0	OT	1850	2930	158.80	33	2673	4638	172.94	46	12.7	2.74
12	FMC 57020	2.0	OT	2115	3438	162.55	32	2587	4493	173.57	42	12.6	2.74
13	Devrinol	1.0	OT	1973	3162	160.25	33	2064	3558	172.34	42	13.6	2.55
14	Devrinol	1.0	PBI	2072	3371	162.58	32	2239	3799	169.68	40	12.4	2.94
15	Enide	6.0	OT	1995	3131	156.93	28	2354	4023	170.88	43	13.3	2.67
16	Check (Cult.)	--	---	1680	2628	156.44	26	1861	3175	170.42	40	11.1	2.99
	L.S.D. .05			NS	NS	NS	NS	529	1259	4.13	NS	2.9	NS
	% C.V.			18	20	4	17	12	13	1.30	17	12	12

2000589652

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 7. The Effect of Glyphosate on Conventional Tobacco Yields, Clayton, NC, 1983.

Tr. No.	Treatment	Rate lb ai/A	Yield lbs/A
1	Check	--	2208
2	Surfactant	--	2103
3	Glyphosate	0.3	1232
4	Glyphosate	3×10^{-2}	2134
5	Glyphosate	3×10^{-3}	2207
6	Glyphosate	3×10^{-4}	2170
7	Glyphosate	3×10^{-5}	2235
8	Glyphosate	3×10^{-6}	2309
9	Glyphosate	3×10^{-7}	2133
10	Glyphosate	3×10^{-8}	2208
	L.S.D. .05		254
	% C.V.		9

2000586953

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 8. Results of Burley On-farm Weed Control Tests, 1983 (% control).

(a)

Herbicide	Hairy galinsoga*	Common ragweed**	% early crop stunting
Paarlan	44	50	2
Prowl	53	43	5
Enide	83	64	1
Devrinol	82	47	3
Check	7	0	0

*Average 6 locations.
**Average 5 locations.

(b)

Herbicide*	Crab-grass	Goose-grass	Fall panicum	Fox-tail
Paarlan	82	85	93	78
Prowl	90	93	95	91
Enide	96	95	97	93
Devrinol	93	93	95	77
Check	0	0	0	0

*Average 3 to 6 locations each.

(c)

Herbicide*	Lambs-quarters	Smart-weed	Pig-weed	Purs-lane	Copper leaf
Paarlan	88	89	90	63	80
Prowl	89	91	92	85	76
Enide	93	93	95	84	97
Devrinol	89	91	95	85	88
Check	0	9	7	5	7

*Average 3 to 6 locations each.

2005869954

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 9. Roundup Rate and Time of Application Test in No-till Tobacco, Kinston and Rocky Mount, NC, 1983.

					Kinston Location									Rocky Mount Location						
					Ave. % control		Ave. % injury	Ave. % yield and quality						Ave. % control				Ave. % injury		Ave. % yield
Tr. No.	Herbicides	Rate lb ai/A	Method appl.	Time	Goose-grass 7/11	Redroot pigweed 7/11	(Stunting) 7/11	#/A	$/A	$/cwt.	Grade index	Ave. % sugar	% TA	Goose-grass 6/18	Goose-grass 7/13	Carpet-weed 6/18	Carpet-weed 7/13	(Stunting) 6/18	(Stunting) 7/13	Green leaves per 10 plants 8/1
1	Roundup	1.5	GK1	1 month	80	94	14	1140	1989	174.47	58	9.43	3.09	63	50	75	62	5	8	14
	Enide	6.0	OT																	
2	Roundup	3.0	GK1	1 month	73	90	29	1064	1838	172.37	57	8.15	2.90	81	71	93	85	4	10	14
	Enide	6.0	OT																	
3	Roundup	1.5	GK2	2 weeks	75	78	28	1075	1880	174.86	58	9.00	2.65	89	81	94	88	10	11	15
	Enide	6.0	OT																	
4	Roundup	3.0	GK2	2 weeks	71	90	44	998	1654	165.73	58	8.38	3.37	94	91	96	91	30	44	12
	Enide	6.0	OT																	
5	Roundup	1.5	GK2	Treat, cut	86	94	34	1202	2023	169.13	54	8.53	3.14	91	85	94	86	16	23	14
	Enide	6.0	OT	and remove																
6	Roundup	3.0	GK2	Treat, cut	78	68	46	1119	1931	172.56	59	8.40	3.25	96	95	93	85	16	24	13
	Enide	6.0	OT	and remove																
7	Paraquat	.5	GK2	2 weeks	73	95	10	1091	1916	171.64	62	12.03	2.89	95	93	95	91	4	6	17
	Enide	6.0	OT																	
L.S.D. .05					NS	NS	27	NS	NS	7.68	NS	2.98	.55	NS	NS	13	NS	NS	NS	NS
% C.V.					18	31	53	13	13	2.2	9.2	18	10	22	24	8	18	112	128	24

2000589555

Source: https://www.industrydocuments.ucsf.edu/docs/ntyk0000

Table 10. Interaction Study with Roundup and Enide in No-till Tobacco, Rocky Mount and Clayton, NC, 1983.

Tr. No.	Treatment	Rate lb ai/A	Appl. method	Rocky Mount Location Ave. yield Green leaf weight per 10 plants lbs.	Clayton Location Ave. yield Green leaf weight per 10 plants lbs.
1	Roundup +	3.0	GK	9.1	6.5
	Enide (TM)*	3.0			
	+ Enide	3.0	OT		
2	Paraquat +	.5	GK	10.6	15.0
	Enide (TM)*	3.0			
	+ Enide	3.0	OT		
3	Roundup	3.0	GK	5.4	5.3
4	Paraquat	.5	GK	9.4	9.7
5	Roundup +	3.0	GK	8.9	12.5
	Enide (Split)	3.0	GK		
	+ Enide	3.0	OT		
6	Paraquat +	.5	GK	15.7	14.2
	Enide (Split)	3.0	GK		
	+ Enide	3.0	OT		
7	Roundup	3.0	GK	10.9	7.3
	Enide	6.0	OT		
8	Paraquat	3.0	GK	13.8	14.0
	Enide	6.0	OT		
	L.D.S. .05			NS	NS
	% C.V.			62	94

*TM = tank mixed.

2000589956

Source: https://www.industrydocuments.ucsf.edu/docs/nfyk0000

Table 11. No-till Tobacco in Legume Covers, Clayton, 1983.

Tr. No.	Treatment	Rate lb ai/A	Method appl.	Cover	Yield lbs/A
1	Paraquat	.5	GKl	Rye	1039
	Enide	3.0			
	Enide	3.0	OTl		
2	Paraquat	.5	GKl	Vetch	--
	Enide	3.0			
	Enide	3.0	OTl		
3	Paraquat	.5	GKl	Clover	--
	Enide	3.0			
	Enide	3.0	OTl		
4	Roundup	1.5	GKl	Rye	701
	Enide	3.0			
	Enide	3.0	OTl		
5	Roundup	1.5	GKl	Vetch	--
	Enide	3.0			
	Enide	3.0	OTl		
6	Roundup	1.5	GKl	Clover	--
	Enide	3.0			
	Enide	3.0	OTl		
7	Conventional Cult. Check				1264
	Enide	6.0	OTl	--	
8	Conventional Cult. Check				1378
	Enide	6.0	OTl	--	
	L.S.D. .05				325
	% C.V.				18

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 12. Preliminary Fertilization Test in No-till Tobacco, Clayton, 1983.

Tr. No.	Treatment	Rate		Ave. yield, quality and chemical constituents #/A	$/A	$/cwt.	Grade index	% sugar	% TA
1	Standard No-till Top dress	500# 8-8-24 167# 15-0-14	2 days after transplant	1833	3258	177.00	60	13.5	2.88
2	Double No-till	500# 8-8-24 500# 8-8-24	2 days after transplant 3 weeks after	3732	6733	181.00	60	10.5	3.93
3	Standard Conventional	500# 8-8-24 167# 15-0-14		1962	3496	178.00	60	9.1	3.71
	L.S.D. .05			NS					
	% C.V.			39					

2000586958

Source: https://www.industrydocuments.ucsf.edu/docs/mjyk0000

Table 13. Time of Application and Transplanting Test in No-till Tobacco, Clayton, 1983

Tr. No.	Treatment	Rate lb ai/A	Time of application and planting		Ave. % control Crabgrass 7/7	Ave. % control Common lambsquarter 7/7	Ave. yield Lbs. green leaf weight per 10 plants 7/7
1	Roundup Enide	1.5 6.0	GK1 OT1	Early	65	56	8.4
2	Roundup Enide	1.5 6.0	GK2 OT2	Late	80	83	2.5
3	Paraquat Enide	.5 6.0	GK1 OT1	Early	91	73	12.7
4	Paraquat Enide	.5 6.0	GK2 OT2	Late	81	71	5.5
5	Conventional Enide	6.0	OT1	Early	87	79	16.9
6	Conventional Enide	6.0	OT2	Late	84	80	13.7
	L.S.D. .05				NS	NS	4.6
	% C.V.				25	22	32

2000589659

Source: https://www.industrydocuments.ucsf.edu/docs/nfyk0000

Table 14. Soil Loss, No-till vs. Conventional Tobacco, Clayton, NC, 1983.

Treatment	Yield* lb/A	Soil loss T/A
No-till	1707	0.05
Conventional	1962	4.03
(Difference	87%	(80X)

Sandy loam soil, 3.1% slope.

*Ave. 2 reps.

Rainfall + irrigation May-Sept. - 15.3 in.

2000586960

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 15. No-till Burley Tobacco Test, Waynesville, 1983.

Tr. No.	Treatment	Method	Ave. yield	% of conv. yield
1	No-till	Flat	3209	113
2	No-till	Bedded	2748	95
3	Conventional	Flat	2842	

2000586961

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

APPENDIX

2000586962

Source: http://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 1. Postemergence Grass Herbicide Test, Rocky Mount, NC, 1983.

Plot Information

1. Crop Variety: McNair 944
2. Transplanting Dates: 5/31/83
3. Plot Size: 3 rows x 45' (1 border, 2 treated)
4. Row Spacing: 48"
5. Plant Spacing: 22"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 4
9. Soil Type: Shubuta loamy sand
10. Percent Organic Matter: 1.0
11. Percent Soil pH: 6.6
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
6/13/83	OT	Large crabgrass - 1-3/sq. ft., 2-3 leaf Goosegrass - <1/sq. ft., 2-3 leaf
7/13/83	LBY	Large crabgrass - 1/sq. ft., 6-12 m Goosegrass - 1/sq. ft., 6-12 m

2000586963

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 2. Postemergence Grass Herbicide Test, Oxford, NC, 1983.

Plot Information

1. Crop Variety: Speight G-28
2. Transplanting Dates: 6/2/83
3. Plot Size: 3 rows x 45' (1 border, 2 treated)
4. Row Spacing: 48"
5. Plant Spacing: 22"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 4
9. Soil Type: Helena sandy loam
10. Percent Organic Matter: 1.0
11. Percent Soil pH: 5.9
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
6/16/83	OT	Large crabgrass - 1-3/sq. ft. on row edge 4-5 leaf and 3-5/sq. ft., 1-2 leaf all over
7/28/83	LBY	Large crabgrass - 3-5/sq. ft., 8-10 m, - to 4-5 leaf

20005869964

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 8. Results of Burley On-farm Weed Control Tests, 1983 (% control).

(a)

Herbicide	Hairy galinsoga*	Common ragweed**	% early crop stunting
Paarlan	44	50	2
Prowl	53	43	5
Enide	83	64	1
Devrinol	82	47	3
Check	7	0	0

*Average 6 locations.
**Average 5 locations.

(b)

Herbicide*	Crab-grass	Goose-grass	Fall panicum	Fox-tail
Paarlan	82	85	93	78
Prowl	90	93	95	91
Enide	96	95	97	93
Devrinol	93	93	95	77
Check	0	0	0	0

*Average 3 to 6 locations each.

(c)

Herbicide*	Lambs-quarters	Smart-weed	Pig-weed	Purs-lane	Copper leaf
Paarlan	88	89	90	63	80
Prowl	89	91	92	85	76
Enide	93	93	95	84	97
Devrinol	89	91	95	85	88
Check	0	9	7	5	7

*Average 3 to 6 locations each.

2000586954

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 4. Tobacco Herbicide Evaluation Test, Reidsville, NC, 1983.

Plot Information

1. Crop Variety: NC 82
2. Transplanting Dates: 5/26/83
3. Plot Size: 3 rows (1 border, 2 treated)
4. Row Spacing: 48"
5. Plant Spacing: 22"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 3
9. Soil Type: Cecil clay loam
10. Percent Organic Matter: 0.6
11. Percent Soil pH: 6.4
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
5/25/83	PBI	
5/26/83	OT	

2000586966

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 5. The Effect of Glyphosate on Conventional Tobacco Yields, Clayton, NC, 1983.

Plot Information

1. Crop Variety: McNair 944
2. Transplanting Dates: 5/10/83
3. Plot Size: 3 rows (1 border, 2 treated)
4. Row Spacing: 48"
5. Plant Spacing: 22"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 4
9. Soil Type: Johns sandy loam
10. Percent Organic Matter: 1.0
11. Percent Soil pH: 5.9
12. Type Sprayer: CO_2 back sprayer
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
6/10/83	OT	Tobacco 8-10 leaves

2005869967

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 6. Roundup Rate and Time of Application Test in No-till Tobacco, Kinston, NC, 1983.

Plot Information

1. Crop Variety: McNair 944
2. Transplanting Dates: 1st - 5/2/83, 5/3/83; All Reset - 5/9/83
3. Plot Size: 2 treated rows
4. Row Spacing: 48"
5. Plant Spacing: 24"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 4
9. Soil Type: Goldsboro loamy sand
10. Percent Organic Matter: 0.9
11. Percent Soil pH: 5.9
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
4/13/83	GK1	Rye cover 4 feet tall
4/28/83	GK2	Rye cover 4 feet tall
5/9/83	OT1	

2000586968

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 7. Roundup Rate and Time of Application Test in No-till Tobacco, Rocky Mount, NC, 1983.

Plot Information

1. Crop Variety: McNair 944
2. Transplanting Dates: 5/31/83
3. Plot Size: 2 treated rows
4. Row Spacing: 48"
5. Plant Spacing: 24"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 4
9. Soil Type: Goldsboro loamy sand
10. Percent Organic Matter: 1.1
11. Percent Soil pH: 6.3
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
4/28/83	GK1	Rye cover 4-5 feet tall
5/19/83	GK2	Rye cover 4-5 feet tall
5/31/83	OT1	

2000586969

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 8. Interaction Study with Roundup and Enide in No-till Tobacco, Rocky Mount, NC, 1983

Plot Information

1. Crop Variety: McNair 944
2. Transplanting Dates: 5/17/83
3. Plot Size: 2 treated rows x 45 feet
4. Row Spacing: 48"
5. Plant Spacing: 24"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 3
9. Soil Type: Shubuta loamy sand
10. Percent Organic Matter: 1.0
11. Percent Soil pH: 6.6
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
4/28/83	GK1	Rye cover 4 to 5 feet tall
5/17/83	OT1	

2000586970

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 9. Interaction Study with Roundup and Enide in No-till Tobacco, Clayton, NC, 1983.

Plot Information

1. Crop Variety: McNair 944
2. Transplanting Dates: 5/4/83
3. Plot Size: 2 treated rows x 45 feet
4. Row Spacing: 48"
5. Plant Spacing: 24"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 4
9. Soil Type: Goldsboro and Wagram loamy sand
10. Percent Organic Matter: 1.0
11. Percent Soil pH: 6.1
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
4/22/83	GKl	Rye cover 4-6 feet tall Ragweed <1/sq. ft., 1"
5/4/83	OT	

20005869?1

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 10. Preliminary Fertilization Test in No-till Tobacco, Clayton, NC, 1983.

Plot Information

1. Crop Variety: McNair 944
2. Transplanting Dates: 5/4/83
3. Plot Size: 2 treated rows x 45 feet
4. Row Spacing: 48"
5. Plant Spacing: 24"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 2
9. Soil Type: Goldsboro and Wagram loamy sand
10. Percent Organic Matter: 1.0
11. Percent Soil pH: 6.1
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
4/22/83	GKl	Rye cover 4-6 feet tall Ragweed <1/sq. ft., 1"
5/4/84	OT	

2000586972

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 11. Time of Application and Transplanting Test in No-till Tobacco, Clayton, NC, 1983.

Plot Information

1. Crop Variety: McNair 944
2. Transplanting Dates: 5/4/84 (early); 5/20/83 (late)
3. Plot Size: 3 rows (1 border, 2 treated x 45 ft.)
4. Row Spacing: 48"
5. Plant Spacing: 24"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 4
9. Soil Type: Wagram loamy sand and Goldsboro loamy sand
10. Percent Organic Matter: 1.1
11. Percent Soil pH: 5.9
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
4/22/83	GK1 (early)	Rye cover 4 to 5 feet tall Ragweed <1/sq. ft., 1"
5/4/83	OT1 (early)	
5/5/83	GK2 (late)	Rye cover 4 to 5 feet tall Ragweed <1/sq. ft., 1-3"
5/20/83	OT2 (late)	

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 12. Time of Application and Transplanting Test in No-till Tobacco, Kinston, NC, 1983.

Plot Information

1. Crop Variety: McNair 944
2. Transplanting Dates: 5/2/83 (early); 5/9/83 (late); early reset - 5/9/83
3. Plot Size: 2 treated rows x 45'
4. Row Spacing: 48"
5. Plant Spacing: 24"
6. Stand Establishment: 40 plants/plot
7. Experimental Design: RCB
8. Replications: 4
9. Soil Type: Goldsboro loamy sand
10. Percent Organic Matter: 0.9
11. Percent Soil pH: 5.9
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
4/13/83	GK1 (early)	Rye cover 4 feet tall
4/28/83	GK2 (late)	Rye cover 4 feet tall
5/9/83	OT1	

Test was later abandoned to dry weather.

20005869/4

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 13. No-till Burley Tobacco Test, Waynesville, NC, 1983.

Plot Information

1. Crop Variety: Kentucky 14
2. Transplanting Dates: 6/23/83
3. Plot Size: 4 rows x 36 feet
4. Row Spacing: 48"
5. Plant Spacing: 24" No-till, 18" conventional
6. Stand Establishment: 20 plants/row
7. Experimental Design: RCB
8. Replications: 4
9. Soil Type: Dyke
10. Percent Organic Matter: 1.2
11. Percent Soil pH: 6.2
12. Type Sprayer: CO_2 backpack
13. Diluent/Carrier: H_2O
14. Spray Volume: 19.1
15. Pressure PSI: 20
16. Type Nozzle: Whirl-chamber
17. Nozzle Size: 49 x 49
18. Nozzles/Row: 2 1/2
19. Nozzle Spacing: 20"
20.

Application Date	Method of Application	Weeds Present and Density
5/26/83	GKl	Rye cover 5-6 feet tall Ragweed <1/sq. ft., 1-3" tall
6/24/83	OT	

2005869925

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 14. RAINFALL

Waynesville, 1983

Date	June	July	August	September
1	.08	.59	.28	.05
2	0	T	0	.21
3	0	.34	0	.11
4	.38	.56	.50	1.17
5	0	.24	0	0
6	.08	.04	0	0
7	.20	0	.95	0
8	.08	0	0	0
9	0	0	0	.01
10	0	0	0	0
11	0	0	0	.02
12	0	0	.21	.04
13	0	0	0	.20
14	0	0	0	1.25
15	0	0	0	0
16	.02	0	0	0
17	.98	0	0	0
18	.13	.12	0	0
19	.15	0	0	0
20	.07	0	0	.06
21	0	0	.02	.21
22	T	0	0	0
23	0	0	0	0
24	0	T	.01	0
25	0	.08	.69	0
26	0	0	.02	0
27	.02	0	.39	0
28	.35	0	.04	0
29	0	0	0	0
30	T	0	0	0
31	0	.01	.26	0
Total	2.54	1.98	3.37	3.33

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 15. RAINFALL

Rocky Mount, 1983

Date	April	May	June	July	August
1	.56	0	0	.47	0
2	0	0	.08	.05	0
3	.15	0	0	0	0
4	0	.72	.07	0	.30
5	0	0	0	0	0
6	0	0	0	.15	.98
7	0	0	0	0	0
8	.61	0	1.18	0	0
9	.27	0	0	0	0
10	.51	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	.16	0	0	0
16	2.17	0	0	0	0
17	0	.30	0	0	0
18	0	0	0	0	0
19	.22	0	0	0	0
20	0	0	0	.43	0
21	0	1.90	0	0	0
22	0	0	0	.28	0
23	0	0	0	0	0
24	.78	.42	0	.54	1.51
25	.13	0	0	0	0
26	0	0	0	.02	0
27	0	.10	0	0	0
28	0	0	0	0	0
29	0	0	0	0	.67
30	0	0	1.20	0	0
31		0		0	0
Total	5.40	3.60	2.53	1.94	3.46

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 16. RAINFALL

Clayton, 1983

Date	April	May	June	July	August
1	0	0	.13	.31	0
2	0	0	0	0	0
3	.13	0	0	0	0
4	0	.50	.20	0	0
5	0	0	.22	1.55	.02
6	.02	0	.20	0	.03
7	.13	0	1.14	0	.35
8	.31	0	0	0	0
9	2.26	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	.07	0	0	0
15	0	.15	0	0	0
16	.77	.09	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	0	0	.15	0	0
20	0	5.20	.25	0	0
21	0	.05	0	0	0
22	0	1.06	0	.73	0
23	0	0	0	.41	.84
24	.55	0	0	.35	0
25	.09	0	0	.05	0
26	0	0	0	0	0
27	0	0	0	0	0
28	0	0	.08	0	0
29	0	.06	.28	0	0
30	0	.04	.27	0	0
31		.01		0	0
Total	4.26	7.23	2.92	3.40	1.24

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 17. RAINFALL

Kinston, 1983

Date	April	May	June	July	August
1	.03	0	.11	.13	0
2	0	0	.05	.30	1.30
3	.20	0	0	0	.04
4	0	.45	0	.30	0
5	0	0	1.32	0	0
6	0	0	0	.17	0
7	.14	0	.05	0	0
8	.41	0	4.35	0	0
9	.40	0	0	0	0
10	.50	0	.02	0	0
11	0	0	0	0	0
12	0	0	0	0	0
13	0	0	0	0	0
14	0	0	0	0	0
15	0	.78	0	0	0
16	1.50	.11	0	0	0
17	0	.02	0	0	0
18	.15	0	0	0	0
19	.17	0	0	0	0
20	0	.03	0	.12	0
21	0	0	.30	0	0
22	0	0	0	.24	0
23	0	.07	0	.48	0
24	.60	.02	0	.08	.31
25	.30	0	0	.02	0
26	0	.05	0	0	0
27	0	.05	0	0	0
28	0	0	0	0	0
29	0	0	0	0	.14
30	0	0	.72	0	0
31		.64		0	0
Total	4.40	2.22	6.92	1.84	1.79

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 18. RAINFALL

Reidsville, 1983

Date	May	June	July	August	September
1	0	0	.01	0	0
2	0	.01	T	.16	0
3	0	0	0	0	T
4	.58	.12	0	0	0
5	0	.17	.10	0	0
6	0	0	0	0	0
7	0	.13	0	.43	0
8	0	.28	0	0	0
9	T	0	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	.41	0
13	0	0	0	0	0
14	.02	0	0	0	.47
15	.09	.49	0	0	.14
16	0	0	0	0	0
17	.49	0	0	0	0
18	0	0	0	0	0
19	0	.12	0	0	0
20	.55	0	0	0	0
21	.65	.13	0	0	.01
22	.08	0	.10	0	.40
23	0	0	.05	0	0
24	0	0	.10	.69	0
25	0	0	T	0	0
26	0	0	.04	0	0
27	.08	0	0	0	0
28	0	0	0	0	0
29	0	.12	0	0	0
30	.66	.34	0	0	.23
31	0	0	0	0	0
Total	3.20	1.91	.40	1.69	1.25

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Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000

Table 19. RAINFALL

Oxford, 1983

Date	May	June	July	August	September
1	0	.04	0	0	.01
2	0	0	0	.25	.03
3	0	0	0	0	0
4	.40	.54	.28	0	0
5	0	0	.77	0	0
6	0	0	0	.06	0
7	0	.02	0	0	0
8	.04	.51	0	0	0
9	0	.01	0	0	0
10	0	0	0	0	0
11	0	0	0	0	0
12	0	0	0	.02	0
13	0	0	0	0	.09
14	.99	.17	0	0	.92
15	.06	.51	0	0	0
16	.30	0	0	0	0
17	0	0	0	0	0
18	0	0	0	0	0
19	T	0	0	0	0
20	2.02	.28	0	0	0
21	.50	.11	0	0	.01
22	.08	.44	.02	0	.24
23	.11	0	0	0	0
24	.05	0	.75	.19	0
25	0	0	0	0	0
26	.09	0	.03	0	0
27	.39	0	0	0	0
28	0	0	0	0	0
29	.03	.71	0	.18	0
30	.01	.03	0	0	.09
31	.46	0	0	0	0
Total	5.53	3.37	1.85	.70	1.39

2000586981

Source: https://www.industrydocuments.ucsf.edu/docs/htyk0000